Let noble thoughts come to us from every side - Rigved

Paramhansa Ramkrishna Maunibaba Shikshan Sanstha's

ANURADHA ENGINEERING COLLEGE

Recognized by A.I.C.T.E. New Delhi,ISO 9001 - 2008 Certified

Permanently Affiliated to Sant Gadge Baba Amravati University,Amravati

1.3.1 Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum

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Courses addressing Environment and Sustainaibility, Professional, social and human ethics, etc

Sr No	Department	Subject Code	Subject Name	Issue Addressed	No of students	Ethics	Gender	Human Values	Enviroment and sustainability
1	Mechanical Engineering	6ME05	NON- CONVENTIONAL ENERGY SOURCES	Environment and Sustainaibility	39				√
2	Information Technology	4 IT 05	SOCIAL SCIENCES & ENGINEERING ECONOMICS	Professional, social and human ethics	79	√	√	√	

3	Electronics & Tele Comm Engg	4ETC05	VALUES & ETHICS(HS)	Social Values & ethics	12	√	√	√	
4	Information Technology	8IT05	PROFESSIONAL ETHICS	Professional ethics	50	√	√	√	
5	Cheminal Engineering	5CH03	ECONOMICS & MANAGEMENT	Professional ethics	43	√		√	
6	Cheminal Engineering	5FECH05	AIR POLLOTION CONTROL	Environment and Sustainaibility	25				√
7	Cheminal Engineering	6FECH05	RENEWABLE ENERGY SOURCES	Sustainaibility	25				√
8	Cheminal Engineering	6CH08	MINI PROJECT	Professional ethics	43	√		√	
9	Cheminal Engineering	7CH04	INDUSTRIAL WASTE TRATEMENT	Environment and Sustainaibility	67				√
10	Cheminal Engineering	7CH10	INDUSTRIAL TRAINING	Professional ethics	29	√	√		
11	Cheminal Engineering	7CH11	PROJECT & SEMINAR	Professional ethics	29	√			
12	All Branches	4th Semester	ENVIRONMENTAL STUDIES	Environment and Sustainaibility	209		√		√

Courses addressing Environment and Sustainaibility, Professional, social and human ethics, etc

Sr No	Program Organised	Guest	Date	Ethics	Gender	Human Values	Enviroment and sustainability
1	Atmadhyan Chitramalika	Anisa Mahabale	11 11 2022	√	√	√	
2	Holy literature presentation	Hari Narayan Das & Kurma Kripa Das ISKCON, Juhu, Mumbai		√	√	√	
3	Webinar on Stress Management	Dr Anilkumar Garg	28 05 2021	√	√	√	
4	Sarod Recital	Pt. Pradeep Kumar Barot by SPIC MACAY	18 10 2022			√	
5	4th National Conference on Green Technology for Sustainable Development		7 05 2023	√		√	√
6	Development of Energy Sources	Mr. Rohan Saoji				√	√
7	1000 trees plantation (Kawad Yatra)	Dept. of Chemical Engg.	18 02 2023		√	√	√
8	Beti Bachao Beti Padhao Abhiyan	NSS Students	10-14 01 2022		√	√	

9	Tree Plantation	NSS Students	02 07 2022				√
10	Swachata Abhiyan	NSS Students	02 10 2022		√	√	√
11	Tree Plantation	NSS Students	15 08 2022				√
12	Teachers Day Celebration	All Staff and students	05 09 2022		√	√	
13	Azadi Ka Amrit Mathosav	All Staff and students	5 August 2022 to 17 August 2022	√		√	
14	International Womens Day Celebration	All Lady Staff & Girls Students	5 March 2022, 2023	√	√	√	
15	Nirupan on "Ramayana"	All Staff and students	03-Mar-23			√	
16	Daily National Anthem before the commencement of Classes	All Staff and students	Every Day			√	

1.3.1 ***Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability intothe Curriculum***

- **Additional information/ Supporting Documents**

1. Syllabus of all the subjects providing *crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability*

2. Proofs of different activities carried out to enrich curriculum providing *crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability*

NOTIFICATION

No. 72 /2022 Date : 20 /06/2022

Subject : Implementation of new Syllabi of Semester VII & VIII of B.Tech. (Chemical Engg.) & B.Tech. (Chem.Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester VII & VIII of B.Tech. (Chemical Engg.) & B.Tech. (Chem.Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2022-23 onwards as per ñ**Appendix – A**ò as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

ñ**Appendix A**ò

SYLLABUS OF B.TECH. (CHEMICAL ENGINEERING) SEMESTER VII & VIII (CBCS)

SEMESTER: SEVEN

7CH01 CHEMICAL ENGINEERING OPERATION – III

SECTION - A

UNIT I: Liquid-liquid extraction: Liquid equilibria, Representation in equilateral triangular and rectangular coordinates, choice of solvent: Selectivity Distribution coefficient, Recoverability, Density, Determination of plait point liver rule, single and multistage extraction:

1) Cross current extraction
2) Counter current extraction, fractional extraction. Applications in petrochemical industries, extraction of nuclear fuels and recent advancements in applications. **(8)**

UNIT II: Continuous or differential extraction, Calculation of NTU & HTU, Classification of extraction equipments, stagewise:

i) The mixer settle, Baffle plate columns, Scheibel columns.
Differential
ii) Spray column, Sieve Iray column, packed columns, pulsed columns, centrifugal extractors, and their applications, Design of continuous-contact towers. **(7)**

UNIT III: Principles of leaching, Types of equilibrium, Multistage cross- current, counter current leaching and their graphical and RAT representation. Continuous counter current decantation verify types of solid-liquid extractors, shank system, Rotocel, Ballmamn extractor, Extractor for cellular material, extraction of oil from cellular material, agricultural material and seeds. **(7)**

SECTION - B

UNIT IV: Distillation: Thermodynamics of vapour-liquid equilibrium, Relative volatility, partial pressures, Daltonôs, Raoultôs and Henryôs laws Methods of distillations: - Differential, Flash or equilibrium, Rectification and Batch distillations No. of plates by McCabe Thiele method. **(8)**

UNIT V: Panchon savarit, Lewis method, Reflux ratio, minimum reflux ratio, and Azeotroes, Antonic,Vanlaar. Consistency of system, Generation of Vapour-liq equilibria for unknown system Heringtonôs consistency test. **(7)**

UNIT VI: Introduction to multi component distillation Azeotroic distillation, extractive distillation, steam distillation of plate columns, Sieve trays, valve trays, plate efficiency, factors determining column performance, Bubble cap trays, Packed column : Packings, calculation of enrichment in packed column and design of distillation column. **(8)**

Text Books:

1) Unit Operation in Chemical Engineering: W.L. McCabe & J.C. Smith, Mc-Graw Hill.
2) Mass Transfer Operation: R.E. Treybal.
3) Mass Transfer by Pranav Datta.

Reference Books:

1) Mass Transfer: T K Sherwood, R.I.Pigford, McGraw Hill
2) Chemical Engineering Vol. II: Coulson & Richardson
3) Transport Phenomena and Unit Operations: Geankoplis.

7CH02 CHEMICAL REACTION ENGINEERING - I

SECTION - A

UNIT I: Classification of chemical reactions. Variables affecting the rates of reaction. Kinetics & Thermodynamics. Thermodynamics of chemical reactions. Classification of reactors. Order of reaction & rate constant. **(7)**

UNIT II: Rates of Homogeneous Reactions. Fundamentals of rate equation. Rate equations from proposed mechanism Analysis of simple & complex rate equation. Evaluation of rate equation from Laboratory data. (8)

UNIT III: Interpretation of rate data, Scale up and Design. Constant volume batch reactor. Variable volume Batch reactor. Temperature and reaction rate. **(7)**

SECTION – B

UNIT IV: Single ideal reactors. Ideal Batch Reactor. space time and space velocity, steady state mixed flow reactors, steady state plug flow reactor, Holding-time & space time for flow system. **(7)**

UNIT V: Design for single reactions Size comparison of single reactors Batch reactor, Mixed verses plug flow reactors Variation of reactant rates. General Graphical comparison. Autocatalytic reactions. **(8)**

UNIT VI: Design for multiple reactor system. Reactions in parallel & in series, series-parallel reactions. Batch recycle reactor, Flow recycle reactor. Temperature & pressure effects in single and multiple reactions. Optimum temperature profile. **(8)**

Text Books:

1) Chemical Reaction Engineering: Octane Levenspiel, Wiley Eastern Ltd.
2) Chemical Engineering Kinetics: Smith J.M. McGraw Hill.

Reference Books:

1) Reaction Kinetics for Chemical Engineers, Walas McGraw Hill
2) Elements of Chemical Reaction Engineering, H. Scott Fogler, Prentice Hall.

7CH03 PROCESS DYNAMICS AND CONTROL

SECTION - A

UNIT I : Transmit response of control systems, optimization. (7)

UNIT II: Stability, Root locus, Transient response. Application of root locus to control system. Frequency response methods. Design of Nyquist criteria. (8)

UNIT III: Process applications, Controller mechanisms. (7)

SECTION - B

UNIT IV: Development and control systems for various chemical industries case studies. (7)

UNIT V: Introduction on advanced control techniques as feed forward, control, cascade control, ratio control, adaquative control and digital computer control. (8)

UNIT VI: Dynamics and control of chemical equipments such as heat exchangers, distillation columns, absorption column, etc. (8)

Text Books:

1) Process Control: Pater Harriott, McGraw Hill, New York.
2) Process System Analysis and Control: Koppel Conghawoner McGraw Hill.

Reference Books:

1) Automatic Process Control: D.P. Eckman, Wiley
2) Chemical Process Control: George Stephanopoulos - Prentice Hall of India Pvt. Ltd.
3) Process Systems Analysis & Control: Donald R. Coughanour, McGraw Hill.

7CH04 PLANT DESIGN & PROJECT ENGINEERING

Objectives:

Learning fundamentals and applications of chemical engineering plant design, value engineering, optimization with emphasis on chemical engineering applications, fundamentals of engineering economics and the management decision making processes that are used in engineering problem solving. Understanding the concept of interest and equivalence, learning the methods of engineering economic analysis like present worth, rate of return, annual cash flow and benefit-cost ratio, depreciation, etc.

SECTION - A

UNIT I: Basic considerations in chemical engineering plant design, project identification, project identification, preliminary techno- economic feasibility, process selection, laboratory developments and its importance, pilot plant, scale-up methods, flow diagrams. Selection of process equipments: standard vs. Special equipments, materials of construction of process equipments, specification sheets. **(7)**

UNIT II: Plant Location: Objectives, levels of location problems, factors influencing location of a plant, locational analysis, selection criteria, significance, theories of plant location.

Plant Layout: Meaning of plant layout, design importance and scope, essentials, types of layout, factors influencing layout, dynamics of plant layout, planning for plant design. **(7)**

UNIT III: Cost estimation: equipment costs, cost indices, Williamôs point sixth rule, methods of estimation of fixed capital, product cost estimation. Interest formulae and their applications, time value of money, simple and compound interest, discrete, nominal and continuous rate of return and their relationships, issue and evaluation of bonds, concept of equivalence. **(8)**

SECTION - B

UNIT IV: Depreciation: Introduction, straight line method of depreciation, declining balance method of depreciation, sum of the years- digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation. **(8)**

UNIT V: Replacement and Maintenance analysis: Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset, capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely, practical factors in alternative and replacement investment. (8)

UNIT VI: Inventory control, scheduling a project using CPM/PERT, project management, optimum conditions, optimum production rates in plant operations, optimum conditions in cyclic operations, design reports. **(7)**

Text Books:
1. Max Peters, Plant design and economics for chemical engineers, McGraw Hill
2. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

Reference Books:
1. Chan S.Park, ñContemporary Engineering Economicsò, Prentice Hall of India, 2002
2. Donald G. Newman, Jerome.P.Lavelle, ñEngineering Economics and analysisò Engg. Press, Texas, 2002

7CH05 PROFESSIONAL ELECTIVE - III

(i) INDUSTRIAL WASTE TREATMENT

Objectives:
i) To impart the knowledge about disposal of effluents and the standards for disposal.
ii) To impart the knowledge about biological treatment methods and advanced treatment methods.

SECTION - A

UNIT I: Disposal Effects on Environment:
Effects of industrial wastes on streams, land, air - wastewater treatment plants - water quality criteria. Effluent standards - Process modification - Bioassay studies - Environmental legislation Pollutants Reduction: Waste minimization - House keeping - Volume and strength reduction - Material and process modifications - recycle, reuse and by-product recovery ï Environmental audit. **(7)**

UNIT II: Effluent Treatment:
Conventional methods of treatment and disposal of industrial wastes - Equalization and Neutralization - Separation of solids - Sedimentation and filtration - Coagulation and flocculation, absorption, chemical precipitation, chemical oxidation, Physiochemical treatment methods - Removal of dissolved impurities - Residue management - Combined treatment of industrial and municipal wastes. **(8)**

UNIT III: Biological Treatment Methods:
Principles and methods for removal of suspended impurities and organics - aerobic and anaerobic decomposition of organic matter, Stabilization ponds, activated sludge process, Oxidation ditch. **(7)**

SECTION - B

UNIT IV: Advanced Waste Water Treatment:
Nitrogen removal - Phosphorous removal - Removal of refractory Organics - Removal of dissolved inorganic substances - Chemical precipitation - ion exchange - Reverse Osmosis - Electro dialysis. **(8)**

UNIT V: Industrial Process and Waste Treatment – I:
Manufacturing process, waste water characteristics, composition, effects and appropriate treatment - flow sheets for chemical industries - Petro-chemical industries, Refineries, Pharmaceutical, Textiles - Apparel industries - Metallurgical industries - Steel plants, mines - Power industries - Fertilizer plants - Cement industry. **(8)**

UNIT VI: Industrial Process and Waste Treatment – II:
Manufacturing process, waste water characteristics, composition effects and appropriate treatment flow sheets for Pulp and paper industry - Agro-industries, Sugar - Distilleries, Food processing industry - meat packing, pickles, poultry dairy - Leather tanning. **(7)**

Text Books:
1. Rao.M.N. and Dutta, Waste Water Treatment, Oxford and IBH Publishing Ltd., Calcutta, 2008.
2. Eckenfelder, W.W., Industrial Waste Pollution Control, McGraw Hill Book Co., New Delhi, 2003.
3. S C Bhatia Managing Industrial Pollution.

Reference BookS:

1. Nemerow, N.L., Theory and Principles of Industrial Waste Treatment, Addison Wesley, Reading Mass, 1993.
2. Wastewater Engineering Treatment & Reuse Metcalf & Eddy Inc.

7CH05 PROFESSIONAL ELECTIVE - III
(ii) NEW SEPARATION TECHNIQUES

SECTION- A

UNIT I: Adsorption separations - Review of fundamentals, mathematical modelling of column contactors, pressure swing adsorption, ion chromatography, affinity chromatography, gradient chromatography, parametric pumping, counter-current, simulated counter-current and multidimensional chromatography. **(7)**

UNIT II: Membrane separation processes ï basic concepts, membrane modules, structure and characteristics of membranes. **(7)**

UNIT III: Design considerations of Reverse Osmosis, Ultra Filtration, Electro Dialysis, Gas permeation membranes, Pervaporation, Nano filtration and micro filtration. **(8)**

SECTION – B

UNIT IV: Detailed theories for membrane separations ï concentration polarization, gel formation and fouling, mathematical models for membrane systems with and without concentration polarization, Transport inside the membranes, solution diffusion membranes, porous membranes. **(8)**

UNIT V: Surfactant based separations - fundamentals of surfactants at surfaces and in solution, liquid membrane permeation, and foam separations, micellar separations. **(7)**

UNIT VI: Supercritical fluid extraction - Physicochemical principles, thermodynamic modelling, process synthesis and energy analysis. **(8)**

Text Books:

1. P. C. Wankat, ñLarge scale adsorption and chromatographyò, CRC Press, 1986
2. R.T. Yang, ñGas Separation by Adsorption Processesò, Imperial College Press, 1997.

Reference Books:

1. P.C. Wankat, ñRate Controlled Processesò, Springer Publications, 2005.
2. Seader, ñSeparation Process Principlesò, Wiley Publication, Second Edition, 2008.
3. R. W. Rousseau, ñHandbook of separation process technologyò, John Wiley and Sons, 1987.
4. M. C. Porter, ñHandbook of industrial membrane technologyò, Noyes Publication, Park Ridge, New Jersey, 1990.
5. J. F. Scamehorn and J. H. Harwell, ñSurfactant based separation processes, T. A. Hatton in Vol. 23 of Surfactant science seriesò, Marcel- Dekker., 1989
6. M. A. McHugh and V. J. Krukonis, ñSupercritical fluid extractionò, Butterworth, 1985.

7CH05 PROFESSIONAL ELECTIVE - III
(iii) OPTIMIZATION OF CHEMICAL PROCESSESS

SECTION- A

UNIT I: Nature and organization of optimization problems, fitting models to data, method of least squares, factorial experimental designs, formulation of objective functions. **(7)**

UNIT II: Optimization theory and methods - basic concepts of optimization, optimization of unconstrained functions, one dimensional search, multivariable optimization. **(8)**

UNIT III: Linear programming and applications, nonlinear programming with constraints, optimization of staged and discrete processes. (7)

SECTION – B

UNIT IV: Optimum recovery of waste heat, optimum shell and tube heat exchanger design, optimization of heat exchanger networks. **(7)**

UNIT V: Optimization of multistage evaporators, optimization of liquid- liquid extraction processes, optimal design and operation of staged distillation columns. **(8)**

UNIT VI: Optimal pipe diameter, minimum work of gas compression, economic operation of fixed bed filter, optimal design of gas transmission network, optimal design and operation of chemical reactors. **(8)**

Text Books:

1. T.F.Edger and D.M.Himmelblau, ñOptimization of Chemical Processesò, Mc.Graw Hill, 2001
2. G.S.Beveridge and R.S.Schechter, ñOptimization Theory and Practiceò, Mc.Graw Hill, 1970.

Reference Books:

1. Kalyanmoy Deb, "Optimization for Engineering Design", John Wiley, 1995
2. V.Kafarov, "Cybernetic Methods in Chemistry and Chemical Engineering", MIR Publishers, 1976.

7CH05 PROFESSIONAL ELECTIVE - III
(iv) SMART MATERIALS

SECTION - A

UNIT- I: **Introduction:** Closed loop and Open loop Smart Structures. Applications of Smart structures, Piezoelectric properties. Inchworm Linear motor, Shape memory alloys, Shape memory effect-Application, Processing and characteristics. **(7)**

UNIT- II:**Shape Memory Alloys:** Introduction, Phenomenology, Influence of stress on characteristic temperatures, Modelling of shape memory effect. Vibration control through shape memory alloys. Design considerations, multiplexing embedded NiTiNOL actuators. **(7)**

UNIT- III: **Electro rheological and Magneto rheological Fluids:** Mechanisms and Properties, Characteristics, Fluid composition and behaviour, Discovery and Early developments, Summary of material properties. Applications of ER and MR fluids (Clutches, Dampers, others). **(7)**

SECTION – B

UNIT- IV: Fibre Optics: Introduction, Physical Phenomenon, Characteristics, Fibre optic strain sensors, Twisted and Braided Fibre Optic sensors, Optical fibres as load bearing elements, Crack detection applications, Integration of Fibre optic sensors and shape memory elements. **(8)**

UNIT- V:Vibration Absorbers: Introduction, Parallel Damped Vibration Absorber, Analysis, Gyroscopic Vibration absorbers, analysis & experimental set up and observations, Active Vibration absorbers. Control of Structures: Introduction, Structures as control plants, Modelling structures for control, Control strategies and Limitations. **(8)**

UNIT-VI: Case Studies: MEMS Magnetic actuators, BP sensors, Microphone, Acceleration sensors, Gyro, MEMS Product development: Performance, Accuracy, Repeatability, Reliability, Managing cost, Market uncertainties, Investment and competition **(8)**

Text Books:

1. "Smart Structures – Analysis and Design", A.V.Srin ivasan, Cambridge University Press, New York, 2001, (ISBN:0521650267).
2. "Smart Materials and Structures", M.V.Gandhi and B.S.Thompson Chapmen & Hall, London, 1992 (ISBN:0412370107)
3. "Foundation of MEMS, by Chang Liu. Pearson Educa tion. (ISBN:9788131764756)

Reference Books:

1. Banks HT, RC Smith, Y Wang ,Smart Materials and Structures", , Massow S A, Paris 1996.
2. Clark R L, W R Saunolers ,G P Gibss,"Adaptive Structres", Jhon Wiles and Sons, New York, 1998.
3. Esic Udd, An introduction for scientists and Engineers", Optic Sensors : Jhon Wiley & Sons, New York, 1991 (ISBN : 0471830070.

7CH06 CHEMICAL ENGINEERING OPERATION–III (MASS TRANSFER-II) - LAB.

List of Experiments:

1. To prepare boiling point (B.P.) diagram and plot x-y data on the equilibrium diagram.
2. Verification of Rayleigh's equation for differential (Batch) distillation.
3. To construct equilibrium curve from vapour liquid equilibrium (VLE) data.
4. To find the composition of distillate and residue after distilling n- butanol-methyl alcohol mixture by simple distillation.
5. To determine vaporization efficiency and thermal efficiency in case of steam distillation.
6. To construct a ternary diagram for acetic acid – water-benzene system.
7. To study the performance of sieve tray extraction column and compare it with packed column (or spray column).
8. To find out number of stages in multistage continuous counter current operation and in single stage multiple contact of operation for solid liquid extraction (Leaching).
9. To compare single stage with two stage cross current liquid-liquid extraction with partially miscible solvent.
10. To compare single stage with two stage cross current extraction for a system in which solvents are immiscible.

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

7CH07 CHEMICALREACTIONENGINEERING-I - LAB.

List of Experiments:

1. To determine the rate constant of saponification of ethyl acetate characterized byan acid like HCL.
2. To determine the activation energy of hydrolysis of an ester such as ethyl acetate.
3. To determine the kinetic of reaction between ethyl acetate and sodium hydroxide at room temperature using differential method of analysis.
4. To determine the kinetics of reaction between ethyl acetate and sodium hydroxide at room temperature by integral method.
5. Show that the decomposition of H2O2 in aqueous solution as first order reaction and determine value of rate constant.
6. To determine void volume porosity of catalyst particle.
7. To determine the RTD curve for packed bed reactor.
8. To determine the RTD curve for PFR.
9. To determine the RTD curve for mixed flow reactor.
10. Verification of performance equation of batch reactor.

Note: The students should perform minimum EIGHT (8) experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list**.**

7CH08 PROCESS DYNAMICS AND CONTROL – LAB.

List of Experiments:

1. Sketch the response of the first order system for impulse change.
2. To find the response of a bare measuring thermometer. c) +ve step change d)-ve step change.
3. To find the response of mercury thermometer (kept in a thermal cell) for bare thermometer) +ve step change d)-ve step change.
4. To study under-damped response of manometer fluid with pressure change function.
5. To study the response of non-interacting system use in two tank for step change in flowrate.
6. To study the response level in one tank c) step change d) impulse change.
7. To verify efficiency of transportation lag when coupled with first order system.
8. To study a liquid level on-off controller.
9. To study the temperature control system.
10. To study the temperature control system.
11. To measure liquid level by bubbler system.

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

7CH09 PROFESSIONALELECTIVE - III - LAB.

Minimum EIGHT experiments based on the syllabus are to be performed.

7CH10 INDUSTRIAL TRAINING

During the course of study from III to VII semester each student is expected to undertake a minimum of two industrial visits and undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of VII semester for 50 marks.

07CH 11 PROJECT & SEMINAR

SEMINAR:
Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/ survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks. The Seminar Report will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:
The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Chemical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination at the end of VIII Semester carries 75 marks will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

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SEMESTER: EIGHT

8CH01 TRANSPORT PHENOMENON

SECTION-A

UNIT-I : Transport properties and mechanism, Rate process, flux, types of fluids, phenomenological laws, Rheology of non-Newtonian fluids, flow through circular pipes, Mathematical foundation, types of time derivatives, Divergence, Operators. **(7)**

UNIT-II : Control Volume, Overall mass, momentum and energy balances, Extended Bernoulliôs equation, Reynoldôs transport equation, mass balance with chemical reaction. **(7)**

UNIT-III : Equation of change based on differential balance, equation of continuity, Navier-Stokes equation, energy equation, application of Narier-Stokes equations to various flows through different geometric shapes, applications of energy equation, potential streamline, creeping andideal flow. **(8)**

SECTION-B

UNIT-IV: Flow around submerged solids, flow past flat plate, boundary layer, Prandtl equation, expressions for viscous drag, thermal boundary layer. Von Karmonôs integral momentum equation, analysis of integral equation, displacement thickness. **(8)**

UNIT-V: Turbulent flow mechanism, intensity of turbulence, Reynoldôs sitresses, Prandtl mixing length, turbulent flow through circular pipes. Analogies of transfer processes, profiles of gradients, Reynoldôs Prandtl, Von Karmon, Chilton-Coulburn analogies, J factors, Dittus-Boelterôs equation. **(8)**

UNIT-VI : Review of classical mass transfer problems, mass transfer in binary systems with or without chemical reactions. Theories of interphase mass transfer. Mass transfer analogies. **(7)**

Text Books:

1) Transport Phenomenon: Bird, Stayward, Light Foot, John Wiley.
2) Momentum, Heat and Mass Transport: Benett and Mayers, McGraw Hill.

Reference Books:

1) Principles of Unit Operations: A.S. Foust, et-al, Wiley Toppan Int. Ed., Latest Edition
2) Fluid Dynamics and Heat Transfer: J.G. Kundsen and Katz, McGraw Hill, Latest Edition
3) Transport Phenomenon and Unit Operations: Geankoplis.

8CH02 CHEMICAL REACTION ENGINEERING-II

SECTION – A

UNIT-I: Residence time distribution. Models for non-ideal flow. (7)

UNIT-II: Mixing concept and models: Rate equation for Heterogeneous reactions, fluid particle Reactions. Determination of rate controlling step. Application to Design. **(8)**

UNIT-III: Fluid-Fluid reaction: The rate equation for different cases and application to design. **(7)**

SECTION - B

UNIT-IV: Heterogeneous processes, catalysis and adsorptional determination of surface area, void volume. Pore volume distribution catalyst preparation, promoters and inhabitation catalyst reactivation. **(8)**

UNIT-V: Rate equation for third solid catalytic, reactions. Internal External transport process in Heterogeneous Reactions. **(7)**

UNIT-VI: Design of Heterogeneous catalytic reactors, fixed broad reactors, isothermal and adiabatic fixed bed reactor, non- isothermal & non-adiabatic fixed bed rector. Fluidized bed, Drickle bed, slurry reactor. **(8)**

Text Books:

1. Chemical Reaction Engineering, Octave Levenspil, Wiley Eastern Ltd.
2. Chemical Engineering Kinetics, Smith J.M., McGraw Hill.

Reference Books:

1. Elements of Chemical Reaction Engineering - H. Scott Fogler, Prentice Hall.
2. Chemical Reactor Analysis & Design, Gilberth F. Froment & Kenneth B. Bischoof, John Wiley & Sons.
3. Chemical Reactor Design, Vol. I & II, M. W. Rase.

8CH03 SYSTEM MODELLING

SECTION – A

UNIT-I: Introduction: Models and model building, principles of model formulation, fundamental laws - continuity equation, energy equation, equations of motion, transport equations, equations of state, equilibrium and kinetics, classification of mathematical models. Numerical solutions of model equations ï Linear and non linear algebraic equations in one and more than one variables, ordinary differential equations in one and more than one variable. **(8)**

UNIT-II: Lumped Parameter Models: Formulation and solution techniques to be discussed for Vapour liquid equilibrium models, dew point and flash calculations for multi-component systems, boiling operations, batch and continuous distillation models, tank models, mixing tank, stirred tank with heating. **(7)**

UNIT-III: CSTR with multiple reactions. Non-isothermal CSTR - multiplicity and stability, control at the unsteady state. Non-ideal CSTR models - multi-parameter models with dead space and bypassing, staged operations **(7)**

SECTION - B

UNIT-IV: Distributed Parameter Models (Steady State): Formulation and solution of split boundary value problems - shooting technique, quasilinearization techniques, counter current heat exchanger, tubular reactor with axial dispersion, counter current gas absorber, pipe line gas flow, tubular permeation process, pipe line flasher. **(8)**

UNIT-V: Unsteady State Distributed Parameter Models: Solution of partial differential equations using finite difference method, convective problems, diffusive problems, combined convective and diffusive problems. Unsteady state conduction and diffusion, unsteady state heat exchangers, dynamics of tubular reactor with dispersion. Transfer function models for distributed parameter systems. **(8)**

UNIT-VI: Model Parameters Estimation: Introduction, method of least squares, curve fitting, parameter estimation of dynamic transfer function models ï step and impulse response models, Auto regressive Moving Average models, least square and recursive least square methods, parameter estimation of RTD models - moments method. **(7)**

Text Books:

1. Roger E. Franks, ñModelling and Simulation in Chemical Engineeringò, John Wiley and Sons, 1972.
2. W.F. Ramirez, ñComputational Methods in Process Simulationò, Butterworth Publishers, 1989.

Reference Books:

1. Seinfeld and Lapidus, ñMathematical Methods in Chemical Engineeringò, Prentice Hall, 1974.
2. W.L.Luyben,ò Process Modelling, simulation and Control for Chemical Engineersò, 1990.
3. Santosh Kumar Gupta, ñNumerical Methods for Engineersò, Tata McGrawHill, 1995.

8CH04 PROFESSIONAL ELECTIVE - IV
(i) PETRO CHEMICAL TECHNOLOGY

SECTION-A

UNIT- I: General Introduction - History, economics and future of petrochemicals, energy crisis and petrochemical industry, sources and classification of petrochemicals, different feedstock,Types of cracking Process **(7)**

UNIT- II: First generation petrochemicals - alkanes - C1, C2, C3, C4 petrochemicals, alkenes -C2, C3, C4, petrochemicals, alkynes - C2, C3, C4 petrochemicals, B-T-X aromatics, diene based petrochemicals. **(7)**

UNIT- III: Second generation petrochemicals - synthesis gas, methanol, formaldehyde chloromethanes, ethanol, acetaldehyde, acetic acid, acetic anhydride, isopropyl alcohol, ethylene oxide, propylene oxide, acetone, vinyl chloride, phenol, aniline and styrene. **(8)**

SECTION - B

UNIT- IV: Third generation petrochemicals - plastics, rubbers and fibres, olefinic polymers, polyethylene, polypropylene, polyisobutylene, diene polymers - polybutadiene, neoprene, polyisoprene, SBR, synthetic fibres. **(7)**

UNIT- V: Miscellaneous petrochemicals - petroleum proteins, synthetic detergents, resin and rubber chemicals, explosives - TNT and RDX. **(8)**

UNIT- VI: Various technological forecasting of the petroleum and petrochemicals. **(8)**

Text Books:

1. S.Maiti, ñIntroduction to petrochemicalsò, Oxford and IBH publishing Co.,1992.
2. H.Steines, ñIntroduction to petrochemical Industryò, Pergamon, 1961.
3. I D Mall Petrochemical Process Technology.

Reference Books:

1. G.D.Hobson and W.Pohl, ñModern Petroleum Technologyò, Applied Science Publishers, IV Edition, 1975
2. Richard frank Goldsten and A.Lawrence Waddams, ñThe Petroleum Chemical Industryò, E&FN Spon Ltd., 1967
3. G.T.Austin, ñShreves Chemical Process Industriesò, McGraw Hill, V Edition, 1986

8CH04 PROFESSIONAL ELECTIVE - IV
(ii) INDUS1RIAL PIPING

SECTION - A

UNIT-I: Importance of piping in chemical industry. Classification of pipes: - Pipe codes and specification, Schedule numbers, BWG, NPS. **(7)**

UNIT-II: Material of construction of pipes. Pipe sizing: - Calculation of pipe diameter, thickness. Pipe fittings, advantages, calculation of frictional losses, and empirical correlations for flow of oil. Gasoline, hydrocarbons. **(8)**

UNIT-III: Criteria for selection of pipe joints, pipe joints for similar and dissimilar material, expansion effects and methods for reducing them. **(7)**

SECTION - B

UNIT-IV: Piping lay-out consideration, piping diagrams, types of pipe support, erection and maintenances of supporting, restraining and braing systems. Complex pipelines in series and in parallel. **(8)**

UNIT-V: Calculation of equivalent lengths. Pipeline storage capacity. Fundamental considerations in piping vibrations, types of vibrations, their prevention and control. Cryogenic piping. **(8)**

UNIT-VI: Single phase and two-phase flow. Piping for slurries. Insulation for piping systems. **(7)**

Text Books:

l. Piping Design for Process Plants by H. F. Rase, John Wiley.
2. Process Piping Systems, D. J. Deutsch, Chemical Engineering Magazine, McGrawHill.

Reference Book: Industrial Piping, C.T. Littleton, McGraw Hill.

8CH04 PROFESSIONAL ELECTIVE - IV
(iii) ENERGY & ENVIRONMENT ENGINEERING

SECTION - A

UNIT-I: INTRODUCTION TO ENERGY SOURCES: Global Energy, Environmental Resources, Energy necessity and energy crisis. Indian Energy Scenario: Energy Consumption, needs and crisis, energy sources and availability. **(7)**

UNIT-II: RENEWABLE SOURCES OF ENERGYAND ENVIRONMENT:

Biomass ï introduction, energy plantation, bio-mass conversion technologies (wet and dry process), photosynthesis, agricultural waste derived energy, urban waste derived energy.

BIOGAS: Generation, factors affecting bio-digestion, advantages of anaerobic digestion, classification of bio-gas plants. **(7)**

UNIT-III: HYDROPOWER: Site selection for hydroelectric power plants, classification of hydroelectric power plants, submergence, ecological imbalance, catchment area treatment, advantages and disadvantages of hydroelectric power plants. Submergence, Ecological Imbalance, Catchment Area Treatment (**8**)

SECTION - B

UNIT-IV: SOLAR ENERGY: Solar constants, solar radiation at earth surface, physical principles of conversion of solar radiation into heat. Concentrating collectors (focusing and non-focusing). **(7)**

UNIT-V: TIDAL ENERGY: OTEC (Ocean Thermal Electric Conversion), methods of ocean thermal electric power generation, site selection. Energy from tides ï basic principles of tidal power, components of tidal power plant.

WIND ENERGY: Introduction, basic principles of wind energy conversion. Site selection considerations. Basic components of wind energy conversion system. Wind energy collectors. Natural gas ï classification and comparison of different gas turbine power plants, Associated Environmental Effects. **(8)**

UNIT-VI: NUCLEAR ENERGY: necessity, general components of nuclear reactors, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, Associated Environmental Effects.

GEO-THERMAL ENERGY: introduction, nature of geothermal fields, geo-thermal sources, binary fluid geo-thermal power system and arrangement for hybrid plants. **(8)**

Text Books:

1. Rai, G.D , ñNon-conventional Energy Sourcesò, Khanna Publications.
2. Rao and Parulekar B.B., (1977), Energy Technologyï Non- conventional, Renewable and Conventionalò, 2nd Edition, Khanna Publishers.

Reference Books:

1. Mathur, A.N., and Rathore, N.S., ñRenewable Energy and Environmentò ï Proceedings of the National Solar Energy, Himanshu Publications, Udaipur
2. Saha, H., Saha, S.K., and Mukherjee, M.K., (1990), ñIntegrated Renewable Energy for Rural Developmentò, Proceedings of the National Solar Energy Convention, Calcutta, India,
3. Wilber, L.C., (1989), ñHandbook of Energy Systems Engineeringò, Wiley and Sons
4. The Energy Research Institute (TERI), New Delhi, Publications
5. Ministry of Environment and Forests, Government of India, Annual Reports.

8CH05 PROFESSIONAL ELECTIVE-IV - LAB.

Minimum EIGHT experiments based on the syllabus are to be performed by the students.

8CH06 CHEMICALREACTIONENGINEERING- II - LAB.

List of Experiments:

1. To determine the RTD in CSTR - pulse input.
2. To determine the RTD in PFR - pulse input.
3. To determine the RTD in Packed Bed Reactor - pulse input.
4. To determine the RTD in CSTR - step input.
5. To determine the RTD in PFR - step input.
6. To determine void volume porosity & solid density of catalyst .
7. To determine the Semi batch reactor.
8. To determine the solid fluid heterogeneous Catalytic reaction.
9. To determine the Adiabatic Batch Reactor.
10. To determine Study of adsorption isotherm of calculation of specific surface area of catalyst.

Note: The students should perform minimum EIGHT (8) experiments from the above list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

8CH07 PROJECT & SEMINAR:

The Seminar Report submitted by the student at the end of VII Semester will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:
The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Chemical Technology. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.
The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination, which carries a **total of 150 marks**, will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

SYLLABUS OF B.TECH. (CHEMICAL TECHNOLOGY) (FOOD, PULP & PAPER, OIL & PAINT AND PETROCHEMICAL TECHNOLOGY) (C.B.C.S.)

SEMESTER VII & VIII (CBCS)

SEMESTER: VII

7CT01 MASS TRANSFER

Subject Code: 7CT01	Title: Mass Transfer	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

Course Objectives:

1. To learn basic concept of mass transfer, staged and continuous contact equipment design, gas absorption and distillation.
2. To learn basic knowledge of mass transfer equipments.
3. To design mass transfer equipments.
4. Unit operation based on mass transfers.

Course Outcomes: Students will be able to :

1. Explain the basic mechanism of mass transfer including diffusion and convective mass transfer.
2. Find the mass transfer coefficient and solve problems related to inter-phase mass transfer.
3. Explain the gas-liquid contacting process and solve related problems.
4. Solve problems on VLE and problems related to design calculation of distillation column.
5. Familiar with special distillation techniques such as steam distillation and azeotropic distillation.

SECTION - A

UNIT I : Introduction to mass transfer and applications, principles of molecular diffusion, Fickǿs Law: Diffusivity, Diffusion in solids, Concepts of flux and derivation of flux equation, resistance, driving force, equilibrium, direction of mass transfer.

Convective mass transfer, inter-phase mass transfer, Theories of Mass Transfer, individual and overall of mass transfer coefficient for liquid and gas phase. Analogy between momentum, heat and mass transfer. Concept of stage wise contact processes, controlling phase concept, mass transfer in turbulent flow, empirical equations. Schmidtǿs no, shearwood no, applications and problems.

UNIT II: Mechanism of absorption and stripping, equipment for Gas-Liquid contact. Calculation of no. of stages, Kremser equation, plate and packed tower internals, packed tower design, HETP, HTU, and NTU concepts, height of column based on conditions in the gas film, liquid film and overall coefficients. Plate type towers, number of plates, plate efficiency, absorption factor.

UNIT III: Types of distillation, relative volatility, azeotropes, enthalpy, concentration diagram, operating line equations, single flash vaporations and partial condensation. Differential distillation for binary systems.
Equilibrium curve for V-L system, fractionation McCabe-Thiele and Panchon-Savarit methods for multi stage operation. Reflux ratio, optimum reflux ratio and other operating parameters. Reboilers, total and partial condenser. Azeotropic and extractive distillation. Introduction of multicomponent distillation.

SECTION-B

UNIT IV: Extraction and Leaching: Ternary diagram, calculation of number of stages analytically and graphically, solvent selection, operating point, material balance of extraction for different solvent conditions (Miscible and immiscible). Introduction to solid liquid extraction, solid liquid equilibria, stage efficiency. Equipment for leaching, extraction, their sizing and design consideration.

UNIT V: Drying and Crystallization: Principles of drying, phase equilibrium, cross circulation drying, suspended particles drying, rate of drying curve, dryers for solids and pastes, dryers for solutions and slurries i.e. various types of dryers. Material balance across dryer.

Principles of crystallization, Equilibrium, calculation of yield, heat effects, crystal growth, properties of crystals nucleation, fractional crystallization, caking of crystals, various types of crystallizes and their applications.
Membrane separation process (microfiltration, ultra filtration, nano filtration, reverse osmosis)

Unit VI: Adsorption and Humidification: Adsorption equilibria, types of adsorption, properties of adsorbents, single and multi-stage adsorption, adsorption isotherms, principles of adsorption, break through curves, adsorption of liquids, basic equations, adsorption equipments and design aspect.
Humidification: Definitions, wet bulb temperature, dry bulb temperature, types of humidity, Adiabatic saturation temperature, study of temperature humidity chart, enthalpy-humidity charts, Determination of humidity and concept of dehumidification. Equipments for humidification operations.

7CT06 : Practicals: More than (6) six experiments expected

1. To study drying characteristics of a given material under a constant drying condition and determine critical equilibrium moisture content.
2. To measure tower characteristics parameter for various liquid for air flow rate in a counter current force draft cooling tower. To determine the effect of (L/G) and (KaV/L) and estimate the value of mass transfer coefficient Ka for value of (L/G).
3. To verify Reyleigh equation for simple distillation.
4. To estimate diffusivity of vapor in air.
5. Adsorption in packed column.
6. To analyze the performance of lab scale bubble cap column to obtain a desire separation of an alcohol waste product.
7. To determine thermal evaporative efficiency.
8. To determine reaction rate constant.
9. To steady the evaluation of HETP and HTU for separation of mixture into its component by distillation in packed column.

Recommended Books:

1. Principles of Mass Transfer and Separation Processes: Binay K. Dutta, 2nd edition, Prentice Hall of India, 2007.
2. Mass Transfer Operations: R. E. Treybal, 3rd edition, McGraw. Hill. 1983.
3. Heat & Mass Transfer: S. D. Dawande, Central Techno Pub., Nagpur
4. Unit Operation in Chemical Engineering: W. L. McCabe & J. C. Smith, McGraw. Hill.
5. Mass Transfer in fluid system: E.D. Cusseler, Cambridge.
6. Principles of Unit Operation: S. Foust 2nd edition, Wiley, New York 1980.
7. Separation Process Principles-Chemical and Biochemical Operations, J. D. Seader, Ernest J. Henley, D. Keith Roper, 3rd Ed., John Wiley & Sons, Inc.
8. Mass Transfer: T. K. Sherwood, R. I. Pigfor
9. Chemical Engineering: Coulson & Richardson.

Reference Book: Transport processes and Separation Process Principles, C.J. Geankoplis, Prentice Hall of India, 4th Ed. 2004.

7CT02 CHEMICAL REACTION ENGINEERING - I

Subject Code: 7CT02	Title: Chemical Reaction Engineering-I	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

Course Objectives:
1. Student will learn rate equation of homogeneous reaction
2. Students will understand the various methods to analyze the batch reactor data to study the kinetics of homogeneous reaction.
3. Students will learn the performance equation for ideal reactors.

Course Outcomes:
After successful completion of this course student will be able to:
1. Understand the kinetics of homogeneous reaction
2. Interpret batch reactor data to determine the kinetics of homogeneous reaction
3. Design the industrial reactor using kinetic data of pilot /lab scale reactor.
4. Determine the size and type of reactor.
5. Compare the size of various single and multiple ideal reactor system along with recycle reactor
6. Understand the kinetics and design for multiple reactions.
7. Understand the effect of temperature and pressure on conversion.

SECTION-A

UNIT I: Classification of chemical reactions, variables affecting the rates of reaction. Kinetics and Thermodynamics. Thermodynamics of chemical reactions. Classification of reactors. Order of reaction and rate constant. Rate of Reaction, Elementary and non-elementary homogeneous reactions, mechanism of reaction, temperature dependency from thermodynamics.

UNIT II: Rates of homogeneous reactions, fundamentals of rate equation, rate equations from proposed mechanism analysis of simple and complex rate equation. Evaluation of rate equation from laboratory data. Collision and activated complex theories.

UNIT III: Interpretation of rate data, scale up and design. Constant volume batch reactor, variable volume batch reactor, temperature and reaction rate, theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data. Integral and differential methods for analyzing kinetic data, interpretation of constant volume reactor, reversible reaction in parallel and series, catalytic reaction, auto catalytic reaction, reversible reactions. Interpretation of variable volume batch reactions for zero, first and second order reactions, design equation for batch, continuous stirred tank, plug flow reactors for isothermal reaction.

SECTION-B

UNIT IV: Single ideal reactors, ideal batch reactor. Space time and space velocity, steady state mixed flow reactors, steady state plug flow reactor, holding-time and space time for flow system.

UNIT V: Design for single reactions size comparison of single reactors Batch reactor, Mixed verses plug flow reactors Variation of reactant rates. General graphical comparison. Autocatalytic reactions.

UNIT VI: Design for multiple reactor system. Reactions in parallel and in series, series-parallel reactions. Batch recycle reactor, flow recycle reactor. Temperature & pressure effects in single and multiple reactions. Optimum temperature profile. Single and multiple reactions in ideal reactors.

7CT07 Practicals: More than six experiments expected:

1. To study the kinetics of given reaction in batch reactor
2. To study the kinetics of reaction between ethyl acetate and NaOH under ambient condition with excess of ethyl acetate
3. To determine the reaction rate and rate constant for saponification of ethyl acetate and NaOH at ambient condition in PFR
4. To determine the reaction rate and rate constant for saponification of ethyl acetate and NaOH at ambient condition in CSTR
5. To determine the reaction rate and rate constant for saponification of ethyl acetate and NaOH at ambient condition in Cascade CSTR
6. To determine the dispersion No. (D/lu) & N for CSTR using Pulse tracer (RTD in CSTR)
7. To determine the reaction rate constant for fluidized bed reactor
8. To study the effect of temperature on saponification of ethyl acetate and NaOH in batch reactor.

Recommended Books:

1. Momentum Transfer Operation: S .K. Gupta, TMC, Latest edition.
2. Unit Operations of Chemical Engineering: McCabe and Smith, TMC
3. Chemical Engineering Vol. I : Coulson & Richardson, Pergamon.
4. Chemical Reaction Engineering. : Octane Levenspiel, Wiley Eastern Ltd
5. Chemical Engg. Kinetics: Smith J.M. McGraw Hill.
6. Reaction Kinetics for Chemical Engineers: Walas. McGraw Hill.
7. Elements of Chemical Reaction Engineering: H. Scott Fogler, Prentice Hall.

7FT03 SPECIAL TECH - (IV) FOOD TECHNOLOGY

Subject Code: 7FT03	Title: Food Technology -IV	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

SECTION-A

UNIT I: Operation in food processing: Equipment for various operations like clearing, sorting, Grading, size reduction and separation, mixing, filtration, extraction, centrifugation, crystallization etc. Application of heat in concentration, chilling and refrigeration. Thermal processing of foods. preliminary operations, methods of heat sterilization and process time calculations. Food irradiation, Plant hygiene and water supply.

UNIT II: Process technology of cereals, legumes and oil seeds: Post-harvest storage and handling. Insect infection and its control. Mycotoxins incereals, oilseeds and their products. Milling of cereals and legumes. By products of milling industry. Oil extraction, refining. manufacture of margarine, salad Oils, cooking oils, shortening agents, lecithin, CMS etc. Processing of oil seeds for food uses.

UNIT III: Process technology of baking and baked Products: Selection of raw materials, Rheology of dough and dough testing methods. Changes during fermentation of dough, manufacture of bread, biscuits, crackers, cookies, cakes and other bakery products, manufacture of breakfast cereals, puffed cereals, fortified and enriched products, extrusion cooked products, Quality control.

SECTION-B

UNIT IV: Process Technology of Tea & Coffee: Composition and processing, flavor and aroma, methods of evaluation of quality.

UNIT-V: Process technology of cocoa, chocolate, candy and confectionary products: Raw materials, use of additives, Technology of processing of cocoa, Manufacture of chocolate candies and confectionary products. Quality control and standards.

UNIT VI: Special Foods: Weaning and baby foods, processed protein and cereal foods textured proteins, Nutraceuticals, intermediate moisture foods, organic food, novel food, proprietary food, supplementary food for diet and health, simulated milk products, Pre-cooked and instantized foods. Quality food management. Different ingredient and additatives.
Recent advances in the field.

7FT08 SPL. TECHNOLOGY-IV (PRACTICAL) FOOD TECHNOLOGY:

More than six experiments expected;

1. Physico-Chemical analysis of biscuit
2. Physico-Chemical analysis of wheat flour
3. Physico-Chemical analysis of whey powder.
4. Chemical and Instrumental analysis of tea/coffee.
5. Chemical analysis of honey

6. Chemical and Instrumental analysis of Jam, squash
7. Analysis of sodium chloride (purity, matter in soluble in water, water soluble matter other than sodium chloride)
8. Analysis of heavy metal in food stuff.
9. Determination of moisture content in spices and condiments by dean - stark method.
10. Determination of acidity of extracted fat in biscuit
11. Determination of acidity in skim milk powder.
12. Determination of germ oil content in wheat flour
13. Food fortification.
14. Salt content in butter and cheese.
15. Sedimentation value of wheat flour
16. Shelf life study of food products
17. Purity as acetone insoluble in lecithin.
18. Purity of ammonium bicarbonate.
19. Purity of citric acid monohydrate.
20. UHT processing curd making, cheese making, milk processing and standardization
21. Case study like veg. Pizzas.

BOOKS RECOMMENDED:

1. Fundamentals of Food Processing Operations by Jonslyn. M. A. and Heid, J.L.: AVI Publishing Co., Inc Westport, Connecticut.
2. Food Processing Operations, Vols. l,2 and 3 by Jonslyn, M.A. and Heid, J .L.: AVI Publ. Co., INC, Westport Connecticut, Latest Edition.
3. The Freezing Preservation of Foods, Vols., 1,2,3 & 4 Edited by Eople, M J. and Tressler, D. K.: AVI Publ. Co., INC, Westport Connecticut.
4. The Fundamentals of Food Engineering by Charu, S.E.: AVI Publ. Co., INC, Westport Connecticut.
5. Grain storage part of System. Edited by Sinha, R.N. and Muir W E.: AVI Publ. Co., Inc, Westport Connecticut.
6. Technology of cereals with Special reference to Wheat by Kent, N.L.: Pergamon Press, Oxford.
7. Cereal Technology by Matz, Samuel, A.: AVI Publishing Co., INC, Westport Connecticut.
8. Coffee Processing Technology, Vols.1 and 2 by Sivetz M.: AVI Publ. Co., INC, Westport Connecticut.
9. Food Dehyderation, Vol, I and 2 by Copley, M J. and Van Arsdel, W B.: AVI Publ. Co., INC, Westport Connecticut.
10. Modern Methods of Cocoa and Chocolate manufacture by Waters, H. W.: J. & A. Churchill, 40, Glouceter Place, Portman Square.
11. Wheat Chemistry and Technology, Edited by Pomeranz, Y.: American Association of Cereal Chemists, Incorporated St. Paul, Mannesota.
12. Modem Cereal Chemistry by Kent Jenos. D. W Amos, A J.: Foods Trade Press Ltd., 7, Garrick Street, WC. London.
13. Snack Food Technology by Matz, S.A.: AVI Publ. Co,INC, Westport Connecticut.
14. Bailey Industrial. Oil and Fat Products, Edited by Deniel Swern: Interscience Publishers, A division of John Wiley and Sons, New York.
15. Bakery Materials and Methods by Daniel, A.R.: Mac, Laren & Sons, Ltd., London.
16. The Manufacture of Biscuits, Cakes and Wafferôs by Fritsch, J. and Grospicrre: Sir. Issac Pitman and Sons Ltd., London.
17. Surgar Confectionary and Chocolate Manufacture by E. B Jackson and Less, R.: Leonard Hills Books, 24, Market Square, Aylesburry, Books.

7PT03 SPECIAL TECH (IV) PULP & PAPER TECHNOLOGY

Subject Code: 7PT03	Title: Pulp & Paper Technology- IV	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

SECTION-A

UNIT I: Bleaching of wood pulp, basic principles of chlorination and alkali extraction, oxidation bleaching agents-hypochlorite, chlorine dioxide, peroxide and other bleaching agents, reducing agents, acidification and combination stages, determination of bleach requirements.

UNIT II: Modern bleaching processes with following agents chlorine-dioxide, oxygen, ozone, peroxide per acids, enzyme and chelating agents. Their reactions, process variables, pulp properties, advantages disadvantages and equipment selections. Bio-bleaching, fundamentals and economics. Bleaching of post-consumer office waste and deinked newspaper.

UNIT III: Stock preparation, beating and refining, effect on fiber structure, theory of beating, factors affecting beating, stock preparation systems

SECTION-B

UNIT IV: Internal sizing of paper, rosin size and synthetic sizes, wax emulsions, asphalt emulsions, theory of internal sizing, various precipitants, alkaline sizing, fortified sizing.

UNIT V: Filling and loading: objectives, survey of filler properties, manufacture of fillers, preparation and addition of fillers, filler retention, adverse effects of fillers, commercial filling and loading materials, refractive index and scattering coefficient.

UNIT VI: Special additives for wet and dry strength, general considerations and properties, coloring, theory, terms used, dyes and pigments, fastness test, methods of coloring, coloring of special papers.

7PT08 SPL. TECHNOLOGY-IV (PRACTICAL) PULP & PAPER TECHNOLOGY:

More than (6) six experiments expected:

1. Determination of ash content of given paper.
2. Determination of moisture content in paper.
3. Determination of acidity / alkalinity by cold water extract.
4. Determination of acidity by hot water extract.
5. Determination of acidity / alkalinity of paper by pH meter.
6. Determination of water absorbency of paper by KELM absorbency method described the absorbency of paper by particular time interval.
7. Determination of sprit absorbency of paper by KELM absorbency method.
8. Determination of rosin size to given paper sample.

Books Recommended:

1. Pulp and Paper Science & Technology Vol. I & II by C. E. Libby
2. Pulp & Paper Manufacture Vol. I, II, III by MacDonald
3. Hand Book of Pulp and Paper Technology by K.W. Britt 2nd edition.

7OT03 SPECIAL TECH (IV) OIL & PAINT TECHNOLOGY

Subject Code: 7OT03	Title: Oil & Paint Technology - IV	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

(TECHNOLOGY OF SOAPS, DETERGENTS, ESSENTIAL OILS AND GLYCERINE)

SECTION-A

UNIT I: **Surfactants**: Concepts of surface activity, structure of surfactant molecules, hydrophil-lipophil balance, methods for measurement surface activity, mechanism of detergency. Typc of surfactants: Anionic, Cationic, nonionic and amphoteric. Biodegradation of surfactants.

UNIT II: Soaps: Raw materials for soap industry classification and selection of raw materials, properties of soap and soap solutions. Phase separation in soap boiling. Plants and process employed in soap manufacture. Various types of soaps and cleaning preparation.

UNIT III: Detergents: Classification, raw material, plants and process employed in manufacture of detergents, analysis of detergents.

SECTION-B

UNIT IV: Essential oils: Classification and chemical constituents of essential oils, methods of extraction, analysis of essential oils, natural and synthetic perfumery materials for industrial uses.

UNIT V: Glycerine : Manufacture of Glycerine from natural sources, sweet waters, properties spent lyes. Synthetic glycerin: Properties. analysis and utilization of glycerine.

UNIT VI: Application of Surfactants, analysis of soaps, LS.I. methods of testing of soaps and detergents, analysis of essential oils, analysis and utilization of glycerin, recent advances in the field.

7OT08 SPECIAL TECHNOLOGY-IV (PRACTICALS) OIL & PAINT TECHNOLOGY

More than six Experiments expected:

1. Producing fats and fat based products.
2. Mechanical expression of Oil from Oil seeds
3. Refining and hydrogenation of Oils.
4. Evaluation of bleaching Earths. Activated carbon and charcoal.
5. Preparation of soaps and detergents.
6. Preparation of various types of detergents.
7. Preparation and evaluation of wax formulations.

8. Preparation of metallic soaps.
9. Preparation of boiled oil, blown oils and stand oils and their evaluation.
10. Preparation of ester gum.
11. Fat splitting and separation of fatty acids.
12. Analysis of pigment. Oil absorption. hiding power etc.
13. Preparation of paints and its analysis, drying lime. gloss and shade matching.
14. Preparation of cosmetics.

BOOKS RECOMMENDED:

1. Soap: Their Chemistry and Technology: J.G.Khane.
2. Soap Manufacture: J. Davidson. lnerscience Publishers. New York. Latest Edition.
3. Sulphated Oils and Allied Products: D. Burton and G. F. Robertshaw. Chemical Publishing Co., New York, Latest Edition.
4. Surface active agents andôDetergents :A. M. Schwarttz. J. W. Perry and J. Berch, Interscience Publishers, New York.
5. Industrial oil and fat products: A.P.Bailley, Interscience Publishers. New York.
6. Technology of Laundry Soap Manufacture: Small Business Publications, New Delhi
7. House Hold & Industrial Surfactants : Small Business Publications, New Delhi.
8. The Technology of synthetic Detergent : Small Business. Publications, New Delhi.
9. Textiles Chemicals & Auxilaries: H.C. Speed and E. W. K. Schwartz, Reinhold Publications, New York.
10. The Manufacture of Glycerol :G.Martin
11. The Modern Soap Detergent Industries: G.Martin.

7PC03 SPECIAL TECH (IV) PETROCHEMICAL TECHNOLOGY

Subject Code: 7PC03	Title: Petrochemical Technology - IV	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

[REACTOR DESIGN ASPECTS IN PETROLEUM AND PETROCHEMICAL PROCESSES]

Course Objectives:

1. To know the utility and application of various refining processes.
2. To learn brief knowledge of petroleum refining.
3. To learn basic concept of equipment design for refining processes.

Course Outcomes:

1. Subject enriched the students about petroleum refining processes.
2. Subject enriched the students about mechanism and reactions involved, design aspect, material of construction.
3. Able to obtained optimum operating conditions.
4. Carry out the material balance across various refining processes.
5. Able to solve the troubleshooting occurs during processing.

SECTION-A

UNIT I: Design aspects of pipe still heaters, radiant and convection sections, calculation of heat flux, radius and number of pipes, band allowance. Capacity, number of plates, shell thickness, reflux ratio, pressure, temperature and composition calculations.

Type of furnaces, furnace for olefin synthesis, design aspect of furnace, effect of temperature, pressure, feed on product pattern. General processing of crude oil, crude distillation.

UNIT II: Capacity, role of feed stocks, desired product pattern, process variables, raw material for visbreaker, coker and catalytic cracker, deactivation in catalytic cracking, types, mechanism and kinetics.

UNIT III: Reactors for HDS (TBR) mass, transfer effects, various reactions, role of pressure. Characteristics of fluidized bed reactors, parameters, KL model, role of emission phase, wake, diameter of bubble, application of FBR for acrylonitrile production.

SECTION – B

UNIT IV: Details of loading capacities of different reactors in series for catalytic reforming, catalyst properties and composition, space time variation, variation of rates and extents of different reactions in different reforming, hydrocracking and isomerization reactors, problems associated with pressure and corrosion.

UNIT V: Packed bed reactors, multibed reactors, phthalic anhydride production in multi tubuler bed reactor, details of slurry bed reactor, heat and mass transfer, effects in slurry reactors, problems of catalyst and product separation.

UNIT VI: Reactor design aspects for production of styrene, problems of agitation, viscosity rise, mass transfer and heat transfer, power requirement, reactor design for alkylator, cooling systems, agitation and product separation.

Topic to be covered with study of material balance across various units, recent development in the field.

7PC08 SPL. TECHNOLOGY-IV (PRACTICAL) PETROCHEMICAL TECHNOLOGY - II

More than six Experiments expected:

1. General processing of petroleum and petroleum products.
2. Effect of blending agent/additive on performative study of various petroleum products (minimum study of 4 products).
3. Checking stability of various petroleum products during operations (minimum study of 4 products).
4. Various reactors and their performance.
5. Synthesis, characterization and performance of biofuels.
6. Determination of TFC, SFC, break power, break thermal efficiency of various types of petroleum fuel and bio-fuels.

Recommended Books:

1. Petroleum Processing Handbook, edited by John J. Meketta, Marcel Dekker Inc.
2. Robert A. Meyers, Handbook of Petroleum Refining Processes, McGraw Hill.
3. Richard A. Dawe, Modern Petroleum Technology, Volume II, Institute of Petroleum.
4. B. G. Deshpande, óThe World of Petroleumô, Wiley Eastern Ltd.
5. J. H. Gary, G. E. Handwert, Petroleum Refining Technology and Economics, Marcel Dekker Inc.
6. G. N. Sarkar, Advanced Petroleum Refining, Khanna Publisher.
7. J. M. Smith: Chemical Engineering Kinetics. 2nd Edn. McGraw Hill.
8. Octave Levenspiel: Chemical Reaction Engineering, Wiley Eastern.
9. C. G. Hill. Jr.: An Introduction to Chemical Engineering and Kinetics and Reactor Design. John Wiley.
10. J. J. Carbery: Chemical and Catalytic Reaction Engineering. McGraw Hill.
11. A. R. Cooper and G. V. Jeffreys L.: Chemical Kinetics and Reactor Design Oliver and Boyd. Edinburgh.
12. J. M. Coulson. J. F. Richardson and D. G. Peacock: Chemical Engineering. Vol. III, EIBS.
13. K. B. Denbig and IC. Turner: Chemical Reactor Theory. 2nd Edition, Cambridge University Press.
14. O. A. Houghen and K. M. Watson : Chemical Process Principles Part ï III Kinetics and Catalyst, John Wiley.

7CT04 PROFESSIONAL ELECTIVE-III : 1) CORROSION ENGINEERING

<table>
<tr><th rowspan="2">Subject Code: 7CT04</th><th rowspan="2">Title: Corrosion Engineering</th><th colspan="3">Credits = 4</th></tr>
<tr><th>L</th><th>T</th><th>P</th></tr>
<tr><td>Semester: VII</td><td>Total contact hours:</td><td>3</td><td>0</td><td>2</td></tr>
</table>

Course Objectives:

1. To understand the needs for Corrosion Education, The Functions and Roles of an Engineer to prevent Corrosion.
2. Understanding of basic concepts of Corrosion, Corrosion in different materials, Corrosion Electrochemistry, Corrosion Thermodynamics, Kinetics and Applications.
3. To impart the interdisciplinary subject in which Chemical Engineering, Materials Engineering, Electrical Engineering, Civil Engineering and Metallurgy Engineering are involved.
4. Understand the Methodology, Methods and Materials to prevent the Corrosion.

Course Outcomes:

Upon completion of the course, the student should be able to:

1. Describe the Chemistry behind the corrosion, process of corrosion, different factors affecting the rate of corrosion.
2. Discuss Kinetics and different forms of corrosion and will able to recognize the corrosion occurring in the different materials.
3. Explain techniques of corrosion cells, Corrosion avoidance, corrosion failure and the various factors.
4. Students shall understand how to prevent the corrosion, selection of materials for corrosion prevention, how to alter the environment for minimal rate of corrosion, different protection techniques and coating to prevent corrosion.
5. Gain knowledge of corrosion by water, boilers feed water, cooling tower water and the scaling indices of water used in many processes. They will also learn about atmospheric corrosion, its tests as well as behavior and resistance to such corrosion.

SECTION-A

UNIT I: Study of corrosion-Needs for corrosion education, functions and roles of a corrosion engineer, corrosion engineers education, strategic impact and cost of corrosion damage, corrosion basics-why metals corrode, matter building blocks, acidity and alkalinity (pH), corrosion as a chemical reaction, corrosion in acids, corrosion in neutral and alkaline solutions.

UNIT II: Corrosion kinetics and applications of electrochemistry to corrosion-over potential. activation polarization, concentration polarization, ohmic drop, graphical presentation of kinetic data (evans diagrams), examples of applied electrochemistry to corrosion.

UNIT III: Eight forms of corrosion-recognizing corrosion, general or uniform attack, galvanic or two metal corrosion, crevice corrosion, pitting, inter-granular, selective leaching, erosion corrosion, stress corrosion, hydrogen damage.

SECTION-B

UNIT IV: Corrosion failures, factors, and cells- Introduction, information to look for, identifying the corrosion factors, examples of corrosion cells, corrosion avoidance, visualizing corrosion cells. **UNIT V:** Corrosion by water- Importance of water, corrosion and water quality and availability, types of water, cooling water systems, steam generating systems, water treatment, scaling indices.

UNIT VI: Atmospheric corrosion- Introduction, types of corrosive atmospheres, factors affecting atmospheric corrosion, measurement of atmospheric corrosivity factors, atmospheric corrosivity classification schemes, atmospheric corrosion tests, corrosion behavior and resistance.

7CT09 (i) Practicals: More than six experiments expected.

1. To measure the corrosion rate of two different metals
2. Applicability of copper corrosion test for corrosion tendency of liquid chemicals
3. Determination of corrosive tendency of light, middle distillate
4. Determination of corrosion tendency of HSD
5. Determination of corrosion tendency of lubricating oil.
6. Determination of corrosion tendency of engine oil
7. Comparative study of various petroleum and non petroleum oil for corrosion tendency.
8. Instrumental applicability for determination of corrosive components in given sample.
9. Determination of concentration effect on corrosive tendency of given sample.

Reference Books:

1. Pierre R. Roberge, Handbook of corrosion engineering, McGraw-Hill Publication.
2. Mars G. Fontana, corrosione, McGraw-Hill Book Company.
3. Pierre R. Roberge, corrosion engineering principles and practice, McGraw-Hill Publication.
4. Zaki Ahmad, principles of corrosion engineering and corrosion control, Butterworth-Heinemann Publication.
5. By Branko N. Popov, corrosion engineering: principles and solved problems, Elsevier Publication.

7CT04 PROFESSIONAL ELECTIVE-III: 2) POLYMER SCIENCE & ENGINEERING

Subject Code: 7CT04	Title: Polymer Science & Engineering	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

SECTION-A

UNIT I: Historical developments in polymeric materials, Basic concepts & definitions: monomer & functionality, oligomer, polymer, repeating unites, degree of polymerization, molecular weight & molecular weight distribution.

UNIT II: Natural polymers: Chemical & physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins etc.

UNIT III: Raw material for synthetic polymers: Manufacturing of various fractions of crude petroleum important for polymer industry for (a) Raw materials such as ethylene, propylene, butadiene, vinyl chloride, vinylidene dichloride, styrene, acrylic monomers like acrylic acid, acrylonitrile, methacrylic acid, methacrylates, acrylamide etc, (b) polyacids such as phthalic acid, terephthalic acid, isomers and anhydrides etc.

SECTION-B

UNIT IV: Classification of polymers thermoplastic/ thermoset, addition/ condensation, natural /synthetic, crystalline/amorphous, step growth /chain growth, specialty, homochain/heterochain, confirmation: homo & copolymers (detailed graft, block alt, ladder etc. & nomenclature), configuration cis/trans; tacticity, branched/ cross linked, classification of polymers based on end use etc.

UNIT V: Molecular weight and its distribution determination, carothers equation, states of polymers, transition temperatures such as Tg, Tc, Tm, solubility parameter, solution properties, temperature, good/ bad solvent.

UNIT VI: Addition, condensation polymerization mechanism, surface tension & contact angle measurements of different polymeric systems & their wetability with other substances.

7CT09 (ii) Practicals: More than **Six** experiments expected**.**

1. Determine the molecular weight of high polymer by Viscosity measurement
2. Preparation of Phenol-formaldehyde resin by acid catalyst.
3. Preparation of phenol formaldehyde resin by alkali catalyst.
4. Preparation of Urea-formaldehyde resin.
5. Determine the molecular weight of a given polymer by turbidimetry.
6. Preparation of Nylon.
7. Preparation of Polystyrene by free radical polymerisation.
8. Determination of melting point of plastic.
9. Determination of specific gravity of plastic.
10. Determination of acid value of plastic.
11. Identification of plastic by flame and solvent test.
12. Manufacture of product by casting (MMA/Polyester resin).
13. Manufacture of FRP sheet by hand layup method.

Recommended Books:

1. Raw Materials for Industrial Polymers by H Ulrich, Hanser Publication1989.
2. Principles of Polymer Science, by Bahadur and Sastry, Narosa Publishing House 2002.
3. Polymer Science by Gowarikar, Johan wiley and Sons 1986.
4. Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.
5. Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988.
6. Petrochemicals The Rise of an Industry by Peter H. Spitz, Johan Wiley and sons 1988.
7. Polymer Chemistry by Malcolm P. Stevens, Oxford University Press, Inc, 1990.
8. Text book of polymer Science, Billmeyer, John Wiley ans Sons 1984.
9. Principles of Polymer Systems, Rodriguez, Hemisphere Publishing Corpn, 1982.
10. Introduction to Polymer Science and Technology, H. S. Kaufman and J. J. Falcetta, Wiley ï Inter-science Publication, 1977
11. Polymer Science and Technology of Plastics and Rubbers, P. Ghosh.

7CT04 PROFESSIONAL ELECTIVE-III: 3) MANMADE FIBRE TECHNOLOGY

Subject Code: 7CT04	Title: Manmade Fiber Technology	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

SECTION-A

UNIT I: Introduction to technical textile, types of technical textiles, textiles used in industry such as filtration, filter fabric construction- woven, needle felt & knitted filter fabric, finishing treatment of filter fabric, thermal and chemical properties of filter fabric, essential requirements of good filter fabric.

UNIT II: Introduction of High performance fibres: Classification of high performance fibres, Comparison between apparel and high performance fibres, outline of characterization of high performance fibres.

UNIT III: Glass Fibres: Types and composition, manufactures processes, fibre structures, properties and applications. Poly ethylene fibres: types- HDPE, UHMWPE, mnufacturing process, properties and applications ceramic fibres: Classification and fibre formation, composition, structure, properties and application, basalt fibres.

SECTION-B

UNIT IV: Polyurethane elastomeric fibres: Manufacturing processes, fibre properties, application and future trends metallic compound fibres: Aluminium Oxide fibres and lead oxide fibres-preparation and processes, fibre structure, properties and application.

UNIT V: Chemically resistant fibres: PEEK (Polyether ether ketone fibre), PVDF and PTFE fibres, various physical and chemical fibre properties, heat and chemical resistance. Aramids & Co polyesters: fibres formation-fibre & structure properties, performance and application.

UNIT VI: Electro spun and speciality fibres: Basic concepts of electro spinning, fibers characteristics and various end applications. Photovoltaic fibres for energy harvesting, piezo electric fibres, photochromic fibres, hollow and noncircular cross section fibres.

7CT09 (iii) List of Practicals: More than **six** experiments expected**.**

1. Study of weaving preparatory and weaving processes
2. Study of loom drive, loom timing, passage of material and primary motions.
3. Study of precision winding machine
4. Study of drum winding machine.
5. Study of cheese winding machine.
6. Study of various types of yarn tensioners used in winding
7. Study of autoconer and its functions
8. Study of pirn winding machine
9. Study of sectional warping machine
10. Study of beam warping machine.

Recommended Books:

1. Tao X, Smart fibre, fabrics and clothing, Woodhead Publishing, 2001.
2. T. Hongu, P. Tatasuya, Glyn O, New fibres, (Ellis Horwood Series in Polymer Science and Technology), Ellis Horwood, New York, 1990.
3. M. Lewin. EM.Pearce, J. Preston, Hand book of fibre science and technology Vol.4, Marcel Dekkar, New York 1989.
4. Donnet J. B. Bansol R .C Carbon fibres, Marcel Dekkar, New York 1990.
5. Hearle J.W.S., High Performance Fibres, Textile Institute, Woodhead Publishing, 2001.
6. Mukhopadyay. S. K, High Performance Fibres, Textile progress Vol. 25, Textile Institute Manchester, 1993.
7. Characterization of Polymers and Fibres, 1st Edition, Authors: Mukesh Kumar Singh, Annika Singh, Woodhead Publishing, 2021.
8. Fibre Science and Technology, Akira Nakamura, Science Publishers, U.S, 2000.

7CT04 PROFESSIONAL ELECTIVE-III: (4) INDUSTRIAL WASTE TREATMENT

Subject Code: 7CT04	Title: Industrial Waste Treatment	Credits = 4		
		L	T	P
Semester: VII	Total contact hours:	3	0	2

SECTION-A

UNIT I : Environment, pollution, pollutant, Zero pollution, production waste, consumption waste, by product waste salvageable waste, types of pollution causes by wastes, greenhouse effect, Acid rains, Causes of acid rains, effects. Chloroflurocarbon, application of CFCộs in industry role of CFCộs in depletion atmospheric ozone. Other effects of air pollution. Agencies working on pollution control, their constitution, ageing of lakes and resvoirs, thermal stratification of lakes and reservoirs. Case study of wasteless processing.

UNIT II : Legislations of Environment protection, Indian standards for drinking water, effluent discharge, Indian standard codes for disposal of wastes, micro-organisms present in water, water sus-pended solids, turbidity, pH, conductivity, DO, BOD by direct method & dilution method, case sampling methods, Sampling procedures and precaution.

UNIT III: General Treatment: Screening and grease removal, Neutralization, proportioniry, chemical coagulation, sedimentation, filtration, biological treatment: Kinetics of biological growth, various suspended and attached growth processes for the treatment of industrial effluent. Advanced waste water treatment: Ion exchange, activated carbon adsorption, electro dialysis reverse osmosis.
Disinfection of Water: Sterilization and methods for disinfection. Sludge Disposal: Various alternatives for Sludge disposal.

SECTION-B

UNIT-IV : Solid waste management, land pollution, composting, land filling, incineration, types of hazardous waste, treatment of hazardous waste, sources of radioactive wastes, treatment of radioactive waste. Effects of radiations, rewashable and recyclable solid waste, recycling in chemical industries.

UNIT-V: Removal of particulate matter, comparative study of method employed e.g. cyclones, bag filters, precipitators, scrubbers, collectors etc, Pollutions control for fly ash, combustion and gasification plants. Various processes for reducing SOx, NOx emissions.

UNIT-VI: Waste management for industries like Food Industry, Dairy Industry, Sugar Mill, Fertilizer, Pulp and Paper, Sulphonic acid Cement, Tanneries, case studies and corrective measures taken in industry to prevent environmental hazards.

7CT09 (iv) Practicals: **More than six experiments expected.**

1. Determination of Sodium Hydroxide and sodium carbonate in the given alkali solution.
2. Determination of sodium bicarbonate and sodium carbonate in the given alkali solution.
3. Determination of temporary hardness of water sample by Hehnerộs method.
4. Determination of permanent hardness of water sample by alkali mixture i.e. ($NaOH$ +Na_2CO_3).
5. Determination of permanent hardness of water sample by alkali mixture i.e. ($NaHCO_3$ +Na_2CO_3).
6. Determination of hardness of water sample by complexometric method using EDTA.
7. Determination of chlorine in water sample by Mohrộs method.
8. Determination of dissolved oxygen (DO) present in the water sample.
9. Determination of Chemical oxygen demand (COD) present in the water sample.
10. Determination of Biochemical oxygen demand (BOD) present in the water sample.
11. Determination of dissolved solids and suspended solids in sample (Wastewater/water)
12. To study the Turbidity of given water sample using Jackson Candle Turbidity meter.
13. To study the particulate pollution around the institute campus.
14. To determine the dose of coagulating agent for given water sample

Recommended Books:

1. Dr. S. P. Mahajan : Environmental Pollution Control.
2. Matcaff and Eddy : Wastewater Treatment.
3. Rao & Datta : Wastewater Treatment.
4. V. V. Kafaro: Waste less Chemical Processing.

7FT05: SPECIAL TECH (V) FOOD TECHNOLOGY

Subject Code: 7FT05	Title: Sp. Tech (V) Food Technology - V	Credits = 3		
		L	T	P
Semester: VII	Total contact hours:	3	0	0

SECTION A

UNIT I: Process Technology of fruits and vegetables: Pre and post-harvest changes in fruits and vegetables, storage, handing, and canning of fruits and vegetables and their products. Technology of fruits and vegetables juices, purees, concentrates, jams, jellies, marmalades, preserves fruit butters, candied fruits, pickles etc.

UNIT II: **Process Technology of meat and poultry**: Livestock and poultry preparations, slaughter, cutting dressing and grading, various cuts of meat. Post-mortem changes. Preservation and packing of meat, poultry and their products. Quality control in processed meat and poultry products, Microbiological standards. By products of meat and poultry processing industries. Process technology of eggs and their products.

UNIT III: **Process Technology of fish and other aquatic Foods**: Sources, methods offishing, handling and storage processing of fish and fish products, byproducts of fish processing. Fish oils, Standards of fish and fish products, processing of other aquatic foods like crabs, frogs, etc.

SECTION-B

UNIT IV: Process Technology of Milk and Milk products: Composition of milk, processing, storage and distribution of milk, manufacture of cream, ice cream, butter, ghee, evaporated, condensed and skimmed milk, whole and skimmed milk powder and other fermented milk products. Manufacture of cheese. Preparation of Indian milk products like khoa channa, curd and their products, Standards for milk products. Dynamic dairy technology.
Process Technology of Beverages: Carbonated beverages, fruit iuices and R.T.S. beverages, alcoholic beverages, quality control.

UNIT V: Packaging: Functions of packaging materials, rigid and flexible packages, metallic, glass and plastic containers. laminated packaging, requirement of packaging for specific products, aseptic packaging, controlled atmosphere packaging, modified atmosphere packaging. Testing of packaging materials, biodegradable packaging, label, artwork and nutrition table.

UNIT VI: Quality attributes of foods and their evaluation. Analytical methods use in food analysis flavour, aroma and texture of foods, food additives, spices and condiments. Contamination in foods. Mycotoxins.
Food adulteration and Food laws: FSSAI rule and regulations, ISI and Agmark standards, food safety, food quality control & quality assurance, HACCP, ISO 22000. Recent advances in the field.

RECOMMENDED BOOKS:

1. Preservation of Fruits and Vegetables by Girdharilal and Siddappa, G.S.Published by Indian Council and Agricultural Research (ICAR), New Delhi.
2. Fruits and Vegetable Juice Processing Technology Edited by Treassler, D.K. and Jonslyn, M.A., AVI Publishing Co., Inc. Westport, Connecticut.
3. Practical Canning by Lock A., Foods Trade Press Ltd., 7 Garrick Street, W.C.2, London.
4. The Meat Hand book by Levie A, AVI Publishing Co., Inc. Westport, Connecticut.
5. The Science of Meat and Meat Product, Edited by Price, J.F. and Schweigert, B.S: W.H. Freeman and Company, San Francisco.
6. Poultry Products. Technology by Mountney, G J., AVI Publishing Co., Inc. Westport, Connecticut.
7. Fishery By-products Technology by Brody, J., AVI Publishing Co., Inc. Westport, Connecticut.
8. Fish and Food Vols. I,II,III & IV Edited by Brog traom. G. : Academic Press, New York and London.
9. Processed Cheese Manufacture by Dr. Meyer A.: Food Trade Press, London.
10. Drying of Milk and Milk Products by Hall. C. W. and Hendrick, T. I.: AVI Publishing Co., Inc. Westport, Connecticut.
11. Modern Dairy Products by Lampert, I. M.: Eurasia Publishing House, (P) (Ltd.), Ram Nagar, New Delhi.
12. By products from Milk by Webb, B. H. and Whittier, E.O.,: A VI Publishing Co., Inc. Westport, Connecticut.
13. The Chemistry and Testing of Dairy Products by New Lander, J. H. and Atherton, H. V. : Olsen Publishing Co., Milwakee Wisconsis.
14. Food Adulteration by Jacob, T.: Mc-Millan & Co. of India, Ltd.
15. The Spice Handbook of Parry, J. W.: Chemical Publishing Co., New York.
16. Meat Technology by Gerrard F.: Deonord Hill, London.
17. Radiation Technology by Desrosier, N. W.: AVI, Publishing Co., INC, (1960)
18. Symposium: Processing Agricultural and Municipal Wastes, Editedby Inglett, C.E.: AVI Publishing Co., Inc.
19. Introduction of Waste Water Treatment Processes by Ramalho, R. S.: Academic Press, New York.
20. Processed Plant Protein Food Stuffs, Edited by Aultschul, A. M.: Academic Press, London.
21. Chemistry of Food Packaging by Swalam, C.M.: American Chemical Society, Washington D.C.
22. Packaging by Newbaner, R.G.: Van Nostrand, Reinhold Co., New York.

7PT05: SPECIAL TECH. (V) PULP AND PAPER TECHNOLOGY

Subject Code: 7PT05	Title: Sp. Tech (V) Pulp & Paper Technology	Credits = 3		
		L	T	P
Semester: VII	Total contact hours:	3	0	0

SECTION-A

UNIT I: Paper and paper board manufacture: Introduction auxiliary equipments, centricleaners, Sand traps, centrifugal separators and various screens.

UNIT II: Paper making machines: Fourdrinier machine, history and development of fourdrinier, modern fourdrinier machine approach flow system, head box slice, types of slices, drainage and formation on fourdrinier machine.

UNIT III: Advanced twin wire former, multi wire former and use of wet end chemistry in paper machine wet end.

SECTION-B

UNIT IV: Cylinder mold machine: Introduction, history of cylinder machine, vat, stock entries, and couch press, modern formers, cylinder machine felts.

UNIT V: Pick-up and press section: Suction picks-up, open draw and no draw, pressing theory, felts press section arrangements, suction rolls, crowning of press roll, swimming roll, modern press, extended nip press.

UNIT VI: Dryer section: Function of dryer section, theories of drying, cylinder drying, air drying, radiant drying, auxilliary equipment, operations and control, performance calculations. Cost and economics. Recent advances in the field.

BOOKS RECOMMENDED:

1. Advances in papermaking wet end chemistry application technologies, by Martin A. Hubbe and Scott Rosencrance
2. Paper and board grades, volume 18, by Hannu Paulapuro
3. Pulp and Paper Manufacture, 2nd edn., VoI.II, by B.Mac. Donald, Mc Graw-Hill.
4. Pulp and Paper Science & Technology Vol. I & II by C. E. Libby
5. Pulp & Paper Manufacture Vol. I, II, III by Mac Donald
6. Hand Book of Pulp and Paper Technology by K.W. Britt 2nd edition.

7OT05: SPECIAL TECH (V) OIL AND PAINT TECHNOLOGY

Subject Code: 7OT05	Title: Sp. Tech (V) Oil & Paint Technology	Credits = 3		
		L	T	P
Semester: VII	Total contact hours:	3	0	0

(TECHNOLOGY OF SURFACE COATINGS)

SECTION-A

UNIT I: Convertible and non-convertible coatings: Chemical nature of coatings and their properties. Various coating technology in Auto industries like CED, TOPCOAT, 3C1B, 3C2B etc.

UNIT II: Natural resins. Chemistry of drying, Semi-drying and non-drying oils, Chemistry and mechanism of heat and drying.

UNIT III: Manufacture of synthetic drying oils, Processes and Plants employed in refining of drying oils. Their manufacture and properties, solvents, diluents and thinners:

SECTION-B

UNIT IV: Chemistry and technology of synthetic resins.

UNIT V: Pigment and extenders: Pigmentary properties and evaluation of pigments. General outlines of the methods of the manufacture of pigments. Properties and uses of important pigments. Organic pigments and colors.
Color measurement through spectrophotometer considering LAB value, color theory munsell color system. Brief account of primary secondary color.

UNIT VI: Formulation of paints: Printing inks, lacquers, varnishes and. Methods of manufacture of paints, printing inks, and lacquers, I.S.1. Methods for evaluation of paints and printing inks. Application of paint through six axis robot and defects. Paint output parameter testing like gloss, DOI and brief about wave scan (appearance of coating) Recent advances in the field.

RECOMMENDED BOOKS:

1. Outline of Paint Tech: H. Hea
2. Organic Coating Tech.: H. R. Payne
3. Introduction to Drying Oil Tech.: A. R. MiIls
4. Paint and Varnish Manufacture: H. W. Chatfiels
5. Treatise on Coatings: Myas and Long.
6. Printing Inks: C.Ellis, Rainhold PbI., New York.
7. Nitrocellulose Ester Leaquers: F. Zimmer
8. Paint Film Defects: M. Hers
9. Paint and Varnishes: A. S. Khanna
10. O.C.C.I. Paint Technology Manual (5 Volumes)
11. Tech. of Writing and Printing Inks, Small Business Publ.

7PC05: SPECIAL TECH (V) PETROCHEMICAL TECHNOLOGY

Subject Code: 7PC05	Title: Sp. Tech (V) Petrochemical Technology	Credits = 3		
		L	T	P
Semester: VII	Total contact hours:	3	0	0

(PETROCHEMICAL INDUSTRY)

Course Objectives:

1. To know the importance of petrochemical industry.
2. To learn the brief knowledge of petrochemicals.
3. To learn the synthesis of various petrochemicals.
4. To know the applications of various petrochemicals.

Course Outcomes:

1. Students know about feed for petrochemical, impurities in it and techniques to deal with impurities.
2. Subject enriched the students about stochiometry reactions, mechanism and process flow involved.
3. Students know about various routes for synthesis of petrochemicals, economics and future trends.
4. Able to obtain optimum operating conditions.
5. Subject enriched the students about petrochemical processing, principles involved, engineering problems encountered and their solutions.

A state of the art account typically of the following with emphasis in increasing order of depth, wherever possible on (1) routes possible, (2) Stochiometry reaction, mechanism and flow sheet, (3) history, economics and future trends, (4) qualitative discussion of physic-chemical and chemical engineering principles involved and engineering problems encountered in the more favored route.

SECTION-A

UNIT I: Source materials for manufacture of chemicals from hydrocarbons, impurities in source materials and their removal, classification of petrochemicals, separation of individual constituents and mixture in brief.

UNIT II: Synthesis of major olefin building block, ethylene, propylene, butenes, etc. Details of steam cracking, future of ethylene production. Production of acetylene, petroleum and non-petroleum routes and its techno economical details, limitation of acetylene as feedstock.

UNIT III: Synthesis of commercial aromatics, BTX, details of chemical engineering principle involved in their separation, production of synthesis gas, its utility, various routes with its details, oxosynthesis.

SECTION-B

UNIT IV: Derivatives of methane, ethane, propane, butane, synthesis of methanol, formaldehyde, acetaldehyde, acetic acid, ethyl alcohol, halides of methane, halides of ethane, methyl amines, carbon disulphide, ethylene oxides, phenol, aniline, butadiene, ethyl oxides, ethyl benzene, etc. with their applications in various fields.

UNIT V: Synthesis of monomer, caprolactum, hexamethylene diamine, VCM, VAM, phthalic anhydride, acrylonitrile, Bisphenol A, styrene, isoprene, chloroprene, engineering plastics, Teflon, synthetic detergent, resin, explosive, synthetic rubber, raw material for synthetic rubber.

UNIT VI: Energy crises and petrochemical industry, impact of heavy feedstock on petrochemicals, ecology and energy crises, coal as an alternative to oil, natural fuels, synthetic fuels, applicability of saturate hydrocarbons for chemical synthesis, fuel for tomorrow.
Hydrogen, bio-fuels, bio-methane, bio-ethanol, biodiesel synthesis, characterization and application of bio-fuels, future trends in petrochemical industry.

RECOMMENDED BOOKS:

1. R. N. Shreve, J. A. Brink : Chemical Process Industries, 4th edition, Mc Graw Hill, Kogakusha.
2. J. A. Kent : Riegalçs Handbook of Industrial Chemistry, 7th ed., Van. Nostrand Reinhold Co.
3. Robert A. Meyers, Handbook of Petrochemicals Production Processes, McGraw Hill.
4. N. N. Lebedev, Chemistry and Technology of Basic Organic and Petrochemical Synthesis, Volume I and II, Mir Publication.
5. James G. Speight, õThe Chemistry and Technology of Petroleumö, CRC Press.
6. G. A. Purdy, õPetroleum Prehistoric to Petrochemicalsö, McGraw Hill Book Company Inc.
7. S. A. Miller: Acetylene, Vols. I & II, Ernest Benn. Publisher U.K.
8. S. A. Miller: Ethylene and its Industrial Derivatives, Ernest Benn., Publisher U.K.
9. E. G. Nancock: Propylene and its Derivatives, Ernest, Bean, Publisher U.K.
10. E. G. Nancock: Benzene and its Derivatives, Ernest Bean, Publisher U.K.
11. S. B. Chandlia: Oxidation of Hydrocarbons, Sevak Publication.
12. T. Dumas, W. Bulani: Oxidation of Petrochemicals, Chemistry and Technology, Applied Science.
13. R. Long: Production of Polymer and Plastic Intermediates from Petroleum, Butterworths.
14. Articles in Hydrocarbon Processing, Chemical Engineer, Oil and Gas Journal etc. as recommended during the academic session.

07CT 10 PROJECT & SEMINAR

SEMINAR:

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/ survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks. The Seminar Report will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Chemical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination at the end of VIII Semester carries 75 marks will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

8FT01: SPECIAL TECH (VI) FOOD TECHNOLOGY

Subject Code: 8FT01	Title: Sp. Tech (VI) Food Technology	Credits = 5		
		L	T	P
Semester: VIII	Total contact hours:	3	0	4

SECTION-A

UNIT I: Biochemical engineering and fermentation Technology: Metabolic pathways of micro organisms. Parameters for growth, energy, carbon and nitrogen. Sources requirements and biomass, estimation, surface, submergedand solid-state cultures. Kinetics of growth and structured growth models. Measurement of dissolved oxygen, mass transfer coefficient.

UNIT II: Effect of aeration and agitation, Kinetics of substrate utilization. Product yield and biomass production, batch, plug flow and chemostat cultures, Scale up in fermenter design. Types of fermenters. Design and operation of fermentation equipment.

UNIT III: Methods of aeration, agitation and sterilization. Control of contamination in fermenters. Antifoam devices, auxiliary equipment and instrumentation, Product recovery.

SECTION-B

UNIT IV: Fermentation technology of alcohol, alcoholic beverages, vitamins, antibiotics, vinegar, organic acids such as citric acid, lactic acid, solvents. Single cell protein, enzymes and othermiscellaneous products. Cultivation of algae, mushrooms and the starter culture.

UNIT V: Immobilised enzymes, methods of immobilization, properties an application of immobilized enzymes. Reactor design for immobilised enzyme Systems.

UNIT VI: Waste water treatment & water recycling, new special in fermentation technology.

8FT05: SPECIAL TECH. (VI) FOOD TECHNOLOGY - PRACTICALS

More than six experiments expected.

1. Preparation of fruit juices, squash, concentrate.
2. Preparation of jam, jellies, pickles etc.
3. Canning of fruits and vegetables and their evaluation.
4. Processing of meat, fish.
5. Preparation dairy products such as butter, cheese, ice cream.
6. Dehydration of fruits and vegetables and their evaluation.
7. Preparation of bakery products like bread, biscuits, cakes, crackers etc.
8. Preparation and evaluation of confectionery products like hard and soft boiled candies.
9. Preparation of fruit candies and chikkies
10. Preparation of beverages.
11. Evaluation of Michaelis - Menten constant.
12. Determination of BOD, COD and dissolved oxygen by chemical and instrumental methods.
13. Production, recovery and control tests of the fermentation products like alcohols.
14. Production, recovery and control tests organic acids, enzymes.

BOOKS RECOMMENDED:

1. Biochemical Engineering Fundamentals by Bailey, lame, E.: McGraw HiII Book Co.
2. Advances in Biochemical Engineering. Vols. 1 to 6 Edited by Bhose, T.K. and Ficchter, A : Springer Vorlag, Berlin, L Lcidelberg New York.
3. Biochemical and Biochemical Engineering, Science Vols. 1 to 2 Edited by Blakebrough : Academic Press, London and New York.

4. Industrial Fermentation, Vols. 1 & 2 By Under Kofler, L.A.: Chemical Publishing Co., INC, 212, Fifth Avenue, New York.
5. Immobilized Enzymes, Antigens, Antibodies and Peptides, Vols. 1& 2, 3 & 4 Edited by Weetal, H.H.: Marcel Decker, INC New York.
6. Industrial Microbiology by Presscot and Dunn: McGraw Hill Book Co., INC, New York.
7. Industrial Microbiology by Casida, L.E.: John Wiley and Sons, INC, New York.

8PT01: SPECIAL TECH. (VI) PULP & PAPER TECHNOLOGY

Subject Code: 8PT01	Title: Sp. Tech (VI) Pulp & Paper Technology	Credits = 5		
		L	T	P
Semester: VIII	Total contact hours:	3	0	4

[PULP AND PAPER TECHNOLOGY PROPERTIES AND TESTING OF PAPERS AND POLLUTION CONTROL]

SECTION-A

UNIT I: Finishing of paper and board: Operation and benefits of calendering, reeling and wrapping, winders, super calendaring, embossing, cutting of paper, packing of paper in ream and sheet form, dispatch of paper.

UNIT II: Surface treatment of paper and board: Definitions, objectives, general approaches, typical surface treatment processes- coating and surface sizing, factors controlling surface sizing, different types of sizing chemicals used, equipment used for application of surface sizing and coating on paper, preparation of coating colour, adhesives used for coating.

UNIT III: Manufacturing of insulating boards, hard boards, and particle board, raw material used, processing of different pulps, forming machines, and finishing of boards.

SECTION-B

UNIT IV: Energy conservation: Strategies to follow for conserving energy in digester, bleach plant, chemical recovery, boiler, stock preparation and in paper machine.

UNIT V: Analysis and testing: Introduction, test facilities, equipment, BIS, TAPPI and ISO standards used in analysis and testing, testing of pulp, wood, paper and converted products.

UNIT VI: Rag processing, manufacturing of hand made papers, and manufacturing and properties of speciality papers.

8PT05: SPECIAL TECH (VI) PULP & PAPER TECHNOLOGY PRACTICALS:

More than **six** experiments expected:

1. To find out basis weight of paper(gm/m^2)
2. To determine caliper of paper(Thickness)
3. To determine bulk of paper(Cobb value)
4. To determine folding endurance of paper.
5. To determine brightness and opacity of paper.
6. To determine tearing resistance of paper.
7. To determine bursting strength of paper.
8. Manufacturing of handmade paper.
9. Preparation of various GSM paper from semi automatic sheet former.

RECOMMENDED BOOKS:

1. Pulp and Paper Manufacture, 2nd Ed. Vol-II. by B. MacDonald, McGraw Hill
2. Winding machine mechanics and measurements by Dr. David Roisum and Dr. James K. Good
3. Pulp and Paper Science & Technology Vol. I & II by C. E. Libby
4. Hand Book of Pulp and Paper Technology by K.W. Britt 2nd edition.

8OT01: SPECIAL TECH (VI) OIL & PAINT TECHNOLOGY

Subject Code: 8OT01	Title: Sp. Tech (VI) Oil & Paint Technology	Credits = 5		
		L	T	P
Semester: VIII	Total contact hours:	3	0	4

[Technology of Waxes, Cosmetics and other Fat Based Products]

SECTION-A

UNIT I: Waxes: Natural sources classification, chemical composition, extraction refining and processing of waxes, their modification and formulation, synthetic waxes, properties.

UNIT II: Cosmetics: Classification, manufacture and evaluation of cosmetic, preparation such as shampoos, shaving creams, lotions, toileteries and perfumery materials.

UNIT III: Other fat based products: Manufacture and utilization of nitrogen, phosphorous and sulphur containing compounds.

SECTION-B

UNIT IV: Fatty acids: Theory and practice of fat splitting and purification of products, separation of fats and fatty acids and their applications in foods, pharmaceuticals, textile, plastics, leather and other industries. Recent development in the field.

UNIT V: Utilization, testing and evaluation of waxes, testing of cosmetic products, plasticizers and products obtained by inter exterification hydrogenation, oxidation and pyrolysis.

UNIT VI: Recent development in the field.

8OT05 SPECIAL TECH. (VI) OIL & PAINT TECHNOLOGY PRACTICALS:

1. Analysis of butter, ghee, margarine, vanaspati, soap stock, sulphonated and oil spent lyes.
2. Commercial fatty acids and glycerin. Evaluations of detergents.
3. Analysis of Cosmetics products.
4. Analysis of mixture of oils and fats.
5. Analysis of bye products and wastes obtained from oil & allied industries.
6. Preparation and, analysis of some industrially important fatty acids..
7. Analysis of natural & Synthetic Pigments
8. Analysis of raw materials for Paints & Paint products.

RECOMMENDED BOOKS:

1. The Chemistry and Technology of Waxes: A.H. Warth
2. Industrial Waxes: H.Benet (2 Volumes)
3. Fatty Acids and their Industrial Applications: E. S. Pattison
4. Industrial Oil and Fat Products: A. E. Bailey
5. Industrial Chemistry of Fats and Waxes: T. P. Hilditech.
6. Cosmetics Science and Tech.: W. Saggarin
7. Perfumes, Cosmetics and Soaps: W. A. Poucher (Vol.-I ,II, III)
8. Chemistry and Biochemistry of Natural Waxes: P. E. Kolattukudy.
9. Basics of Paint Technology, Part-I, V. C. Malshe, Meenal Sikchi, ICT, Mumbai.

8PC01: SPECIAL TECH (VI) PETROCHEMICAL TECHNOLOGY

Subject Code: 8PC01	Title: Sp. Tech (VI) Petrochemical Technology	Credits = 5		
		L	T	P
Semester: VIII	Total contact hours:	3	0	4

[PETROCHEMICAL ENGINEERING PROCESS ANALYSIS]

Course Objectives:

1. To know the importance of petroleum and petrochemical refining processes.
2. To learn basic principles and applied knowledge of petrochemical process analysis.
3. To learn the stochiometry reaction schemes, mechanism and its importance.
4. To learn mathematical equations for process analysis.

Course Outcomes:

1. Subject enriched the students about type of process, various operating parameters, chemical engineering principles involved, engineering problems encountered in the more favorable routes with their solutions.
2. Able to obtain optimum operating conditions.
3. Able to determine the ōKô values for various processes.
4. Able to know the kinetics of reversible and irreversible exothermic reactions.
5. Students able to carry out material balance and mathematical modeling of process.
6. Able to carry out the qualitative discussion of physico-chemical processes.

SECTION-A

UNIT I: Irreversible exothermic catalytic reaction, comparative data of IECR carried in petrochemical industry, reactors for IECR, kinetic approach, simplification of reaction scheme, mechanism for heat control, factors influencing the operating conditions, finding optimum operating conditions. Mathematical modeling and its details, use of mathematical modeling for finding operating conditions, etc. Oxidation of naphthalene to phthalic anhydride, kinetics, thermodynamics, simple and complex model, fluidized bed versus fixed bed operations.

UNIT II: Reversible exothermic reaction, comparative data of RER carried in petrochemical industry, their important features, kinetic approach, effect of temperature, time on yield, optimization of reaction rate, flow pattern in various reactors, manufacture of ammonia, type of commercial reactors used for ammonia synthesis, kinetics and thermodynamics of ammonia formation, optimum temperature profile achieved in industrial reactors.

UNIT III: Steam cracking of hydrocarbons and petroleum fractions for production of olefins, aim, mechanism, technique uses, process conditions, reactors used, effect of various parameters like hydrocarbon to steam ratio, partial pressure of steam, nature of feedstock, temperature and residence time etc. on conversion.
Equations and relations for adiabatic conditions, isothermal conditions and its applications for calculations, acetylene manufacture and its kinetics.

SECTION-B

UNIT IV: Coal gasification, comparative data of various technology, steam reforming engineering aspects of steam reforming, reactivity of hydrocarbon, steam to hydrocarbon ratio, kinetics and thermodynamics, determination of equilibrium constant, shift reaction, kinetic relations for shift reaction, calculating steam required in shift reaction, material balance across shift converter, multistage shift converter.

UNIT V: Case study of physical process, adsorption isotherm, heat effect in adsorption, steady state and unsteady state adsorption, adsorption techniques, structure of adsorbent, regeneration of adsorbent, hypersorption, fluid char adsorption, cyclic adsorption, application of adsorption for natural gas processing in detail. For example, drying of natural gas, recovery of heavier hydrocarbon from natural gas, desulfurization of natural gas etc. as a complete case study with traditional and commercial routes and its comparison.

UNIT VI: Distillations and its applications, principles of working of following types:
Batch, continuous, primary, stabilization, re-run, vacuum, steam stripping, molecular, per fractionation, azeotropic, extractive. Discussion of above distillation type in petroleum refining and petrochemical industry with chemical engineering principles and engineering problem encountered. Catalyst in petroleum refining and petrochemical process, homogeneous and heterogeneous catalysis, catalyst morphology and activity, catalyst in hydrocarbon oxidation, polymerization, recent advances in industrial catalysis, role of polymers in catalysis.

Note: The paper is taught with necessary mathematical treatment and numerical problems illustrating the physico-chemical and chemical engineering principles, process equipment design, etc.
Topic to be covered with material balance across various units.

8PC05: SPECIAL TECH. (VI) PETROCHEMICAL TECHNOLOGY: PRACTICALS:

More than **six** experiments expected.

Petroleum Refining and Processing:

1. Study of various distillation unit with respect to simple, ASTM, vacuum and its comparative study.
2. TBP distillation of petroleum fraction, construction of property, midpercent, residue yield, distillate yield curve, verification of ASTM, TBP, EFV correlations.
3. Study of spray (bubble column), packed column, York Schibles (mixer settler) for extraction of acid from petroleum fractions into water, determination of efficiency, comparative study.
4. Break through phenomenon in adsorption, characterization curve.
5. Use of modern devices for petroleum and petrochemical analysis like Brookfield viscometer, Karl-Fisher autotitrator, UV spectrophotometer, ultrasonic interferometer, etc.

RECOMMENDED BOOKS:

1. Petroleum Processing Handbook, edited by John J. Meketta, Marcel Dekker Inc.
2. Robert A. Meyers, Handbook of Petroleum Refining Processes, McGraw Hill.
3. Richard A. Dawe, Modern Petroleum Technology, Volume II, Institute of Petroleum.
4. J. H. Gary, G. E. Handnert, Petroleum Refining Technology and Economics, Marcel Dekker Inc.
5. J. M. Smith: Chemical Engineering Kinetics. 2nd Edn. McGraw Hill.
6. C. G. Hill. Jr.: An Introduction to Chemical Engineering and Kinetics and Reactor Design. John Wiley.
7. J. J. Carbery: Chemical and Catalytic Reaction Engineering. McGraw Hill.
8. R. Cooper and G. V. Jeffreys L.: Chemical Kinetics and Reactor Design Oliver and Boyd. Edinburgh.
9. O. A. Houghen and K. M. Watson : Chemical Process Principles Part -III Kinetics and Catalyst, John Wiley.
10. J. A. Kent: Riegalĉs Handbook of Industrial Chemistry, 7th ed., Van. Nostrand Reinhold Co., 1974.
11. N. N. Lebedev, Chemistry and Technology of Basic Organic and Petrochemical Synthesis, Volume I and II, Mir Publication.
12. S. A. Miller: Acetylene, Vols. I & II, Ernest Benn. Publisher U.K.
13. S. A. Miller: Ethylene and its Industrial Derivatives, Ernest Benn., Publisher U.K.
14. S. B. Chandlia: Oxidation of Hydrocarbons, Sevak Publication.
15. T. Dumas, W. Bulani: Oxidation of Petrochemicals, Chemistry and Technology, Applied Science.
16. Articles in Hydrocarbon Processing, Chemical Engineer, Oil and Gas Journal Etc. as recommended during the academic session.

8CT02: CHEMICAL REACTION ENGINEERING II

Subject Code: 8CT02	Title: Chemical Reaction Engineering II	Credits = 3		
		L	T	P
Semester: VIII	Total contact hours:	3	0	0

Course Objectives:

1. Student will understand the rate equation of Homogeneous reaction.
2. Students will understand the reactor design of heterogeneous system.

Course Outcomes:

After successful completion of this course student will be able to

1. Understand the basic aspects of non ideal flow
2. Determine the conversion in a non-ideal reactor using tracer information.
3. Develop the rate equation for heterogeneous reaction.
4. Design the reactor for fluid-fluid reactions
5. Design the reactor for fluid particle reaction
6. Design reactors for solid catalyzed reactions

SECTION-A

UNIT I: Residence time distribution. Models for non-ideal flow. Residence time distribution, single parameter model; non-isothermal reactors;

UNIT II: Mixing concept and models: Rate equation for heterogeneous reactions, fluid particle reactions. Determination of rate controlling step. Application to design, kinetics of enzyme reactions (Michaelis-Menten and Monod models), non-ideal reactors, kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis; rate and performance equations for catalyst deactivation.

UNIT III: Fluid-Fluid reaction: Rate equation for different cases and application to design. Eight design.

SECTION-B

UNIT IV: Heterogeneous processes, catalysis and adsorption determination of surface area, void volume, pore volume distribution catalyst preparation, promoters and inhibition of catalyst reactivation.

UNIT V: Rate equation for third solid catalytic, reactions. Internal external transport process in heterogeneous reactions.

UNIT VI: Design of Heterogeneous catalytic reactors, fixed broad reactors, isothermal & adiabatic fixed bed reactor, non-isothermal & non-adiabatic fixed bed rector, fludized bed, trickle bed, slurry reactor.

BOOKS RECOMMENDED:

1. Chemical Reaction Engineering: Octove Levelspiel, 3rd Edn. J. Wiley Eastern Ltd.
2. Chemical Engineering Kinetics: Smith J.M., Mc Graw Hill, 3rd Edn. 1990.
3. Elements of Chemical Reaction Engineering: H. Scott Fogler, Prentice Hall 2016.
4. Chemical Reactor Analysis & Design : Gilberth F. Froment & Kenneth B. Bischoof, John Wiley & Sons.
5. Chemical Reactor Design: Vol I & II: M W.Rase
6. Chemical Kinetics: Keith J. Laidler, 3rd Edition, Pearson 2013.

8CT03: PLANT DESIGN AND PROJECT ENGINEERING

Subject Code: 8CT03	Title: Plant Design & Project Engineering	Credits = 3		
		L	T	P
Semester: VIII	Total contact hours:	3	0	0

SECTION-A

UNIT I : Project identification, Preliminary techno economic feasibility, Process design aspects selection of process, factors affecting process selection, importance of laboratory development pilot plant, scale up methods, safety factors, Types of flow diagrams.

UNIT II : Detection of process equipmentôs-standard *vs* special equipment, materials of construction for process equipmentôs, selection criteria, specification sheets.

UNIT III: Process auxiliaries - piping design, layout, supports for valves, process control & instrumentation control system design. Process utilities-process water, boiler feed water, water treatment, waste treatment & disposal, oils heating systems, chilling plant, compressed air & vacuum. Plant location & layout-Factors affecting both planning of layout. principles of plant layout, use of scale methods.

SECTION-B

UNIT IV: Cost estimation - factors involved in project cost estimation. Total capital investment, fixed capital & working capital. Methods of estimation of investment, estimation of equipment cost production factors, estimation of total product cost - factors involved in estimating. Depreciation - types of methods of depreciation, evaluation of depreciation methods.

UNIT V: Applied process design of fluid flow and ejectors, process planning, scheduling, flowsheet design, process safety and pressure-relieving devices.

UNIT VI: Economic considerations in process & equipment design, inventory control, scheduling a project using CPM/PERT methods, project management. Option design, general production rates in plant operation. Optimum conditions, optimum production rates in plant operation, optimum conditions in cyclic operation.

Recommended Books:

1. Plant Design & Economics for Chemical Engineering By M.S. Peters & K. D. Timmerhaus, McGraw Hill (Japan), 2nd Edition.
2. Applied Process Design for Chemical and Petrochemical plants, Ernest E. Ludwig, Gulf Professional Publishing (Volume 1).
3. Chemical Engg. Plant Design: F. C. Vibradant & C. E. Dryden, McGraw Hill (New York).

8CT04: PROFESSIONAL ELECTIVE-IV: (i) BIOCHEMICAL ENGINEERING

Subject Code: 8CT04	Title: Biochemical Engineering	Credits = 3		
		L	T	P
Semester: VIII	Total contact hours:	3	0	0

SECTION-A

UNIT I: Introduction: Biochemical Engineering- Interaction of two disciplines, comparison of chemical and biochemical process, role of biochemical engineers in development of modern formation industry, future development, applications of engineering advances.

UNIT II: Kinetics of enzyme catalyzed reactions: Simple enzyme kinetics with one and two substrates, determination of elementary step rate constant, substrate activation and inhabitation, multiple substrate, modulation and regulation of enzyme activity, enzyme deactivation, effect of pH, temperature, inhibitors on enzyme activity.

UNIT III: Design and analysis of biological reactors: Ideal bioreactors, reactor dynamics, microbial dynamics in chemostat culture, mass balance in a series vessel, mass balance with recycle, comparison between batch and continuous cultivation, sterilization reactors, animal and plant cell reactor technology, examples of design calculations, design and construction of fermenter, multiphase reactors.

SECTION-B

UNIT IV: Kinetics of substrate utilization: Ideal reactors for kinetics measurement, kinetics of balanced growth, transient growth kinetics, structured kinetics model, product formation kinetics.

UNIT V: Transport phenomena in microbial systems: Gas liquid mass transfer in cellular system, determination of OTR, mass transfer freely rising or falling bodies, forced convection mass transfer, estimation of overall kla, heat transfer correlation, mass transfer and microbial respiration, theories of diffusional mass transfer.

UNIT VI: Translation of laboratory culture results to plant operations, scale down, data translation, performance of shaker flask, fermentation technology, design and operation of typical aseptic, aerobial fermentation process.

Recommonded Books:

1. J.E. Bailley and D.F.Olis: Bio-chemical Engineering Fundamentals, McGraw Hill, New York, 1977.
2. S.Aiba, A.E. Humphrey and N.R. MHH:Bio-chemical Engineering, 2nd ed. Academic Press, 1973.
3. F.C. Web: Biochemical Engineering, Van Nostrand, 1964.
4. B. Atkinson: Biochemical Reactors, Plon Ltd., 1974.
5. Desai A.V.:Bio-energy, Willey Eastern Ltd. New Delhi, 1990.
6. Lehninger A.L.:Bio-Chemistry, Worth Publication, Inc., New York, 1972.
7. Bungay H.R.,Belfort G.: Advanced Bio-chemical Engineering, John Willey & Sons, New York, 1987.

8CT04: PROFESSIONAL ELECTIVE-IV: (ii) PETROLEUM PROCESSING ENGINEERING

Subject Code: 8CT04	Title: Petroleum Processing Engineering	Credits = 3		
		L	T	P
Semester: VIII	Total contact hours:	3	0	0

SECTION-A

UNIT I: Petroleum exploration production and refining of crude oils: Chemistry and composition (characteristics and constituents of crude oils, classification of crude oils).

UNIT II: Quality control of petroleum products classification of laboratory tests, distillation, vapour pressure, flash and fire points, octane number, performance number, cetane number, aniline point, viscosity index, calorific value, smoke point, char value, viscosity, viscosity index, penetration tests, cloud and pour points, drop point of grease, melting and settling points of wax, softening point of Bitumen, induction period of gasoline, thermal stability of jet fuels, gum content, total sulphur, acidity and alkalinity, copper strip corrosion test, Silver strip corrosion test for ATF, ash, carbon residue (Conradson method, Ramsbottom method) colour, density and specific gravity, Refractive index of hydrocarbon liquids, water separation index (modified) (WSIM), ductility.

UNIT III: Petroleum products: Composition, properties & specification of LPG, Naphthas, motor spirit, Kerosine, Aviation turbine fuels, Diesel fuels, Fuel oils, Petroleum hydrocarbon solvents, lubricating oils (automotive engine oils, industrial lubricating oils electrical insulating oils, Jute batching oils, white oils, steam turbine oils, metal working oils, etc.) petroleum waxes Bitumens, petroleum coke.

Crude oil distillation: Desalting of crude oils, atmospheric distillation of crude oil, vacuum distillation of atmospheric residue, thermal conversion process: thermal cracking reactions, thermal cracking, visbreaking, (conventional visbreaking and soaker visbreaking) coking (delayed coking, fluid coking, flexicoking), calcination of Green coke.

SECTION-B

UNIT IV: Catalytic conversion process fluid catalytic cracking; catalytic reforming; hydro cracking catalytic alkylation, catalytic isomerization; catalytic polymerization.

UNIT V: Finishing process hydrogen sulphide removal processes; sulphur conversion processes; sweetening processes (Caustic treatment, Solutizer process; Doctor treating process; Copper chloride sweetening; Hypochlorite sweetening ;Air and inhibitor treating process; Merox processes; Sulphuric acid treatment; Clay treatment); solvent extraction processes (Edeleanu process, Udex process, Sulfolane process), hydro treating processes.

UNIT VI: Lube oil manufacturing process evaluation of crude oils for lube oil base stocks, vacuum distillation, solvent deasphalting solvent extraction of lube oil fractions (Furfural, NMP and Phenol), solvent dewaxing, hydrofinshing, Manufacture of petroleum waxes (wax sweating, solvent deoiling) Manufacture of Bitumenȏs selection of crude oil, methods of manufacture of bitumenȏs, (distillation, solvent precipitation, air blowing).

RECOMMENDED BOOKS:

1. Nelson, W.L., Petroleum Refining Engineering, McGraw Hill.
2. Mall, ID, Petrochemical Process Technology, McMillan India.

Reference Book: Sarkar, G.N., Advance Petroleum Refining, Oscar Publication.

8CT04: PROFESSIONAL ELECTIVE-IV: (iii) FUEL TECHNOLOGY

Subject Code: 8CT04	Title: Fuel Technology	Credits = 3		
		L	T	P
Semester: VIII	Total contact hours:	3	0	0

SECTION -A

UNIT I: Comparison of various sources of energy. Alternatives to non-renewal sources. Characteristics and distribution, production and total deposits of coal and petroleum in India. Classification of fuels, classification of Coal, formation of Coal (colification process).

UNIT II: Analysis of coal, proximate and ultimate analysis. Significance of analysis. Rank of coal relation with moisture, ash, volatile matter. Reporting of coal analysis. Significance, composition of ash and mineral matter. Properties and testing of coal, calorific value (Gross and net), Bob calorimeter, Boy's gas calorimeter, weathenng index, swelling index, craking index. Grindability Index, specific gravity. Theoretical computations of calorific value.

UNIT III: Testing of oils, viscosity, flash point, pour point, aniline point, carbon residue, diesel index, octane and cetane number moisture content. Preparation of raw of mine coal, washing of coal, washability curves, methods of coal washing, coal washeries in India, Gravity seperation, float and sink rest efficiency of coal washing.

SECTION-B

UNIT-IV: Carbonisation, physical and chemical changes, high and low temperature carbonisation. Modern developments in design of coke ovens. Recovery of by products, Tar distillation. Blending of coals. Fuel economy in steel plants. Properties of metallurgical coke. Straight run distillation of crude oil Thermal transfer and catalytic cracking. Polymerisation alkylation.

UNIT-V: General principles of combustion. Combustion of grates, mechanical stokers, combustion of pulverised coal, Suspenaed bed and fluridised bed combustion. Problems in combustion based on mass and heat transfer with chemical reaction.

UNIT-VI: Gasification of coal, first and second generation gasifiers, design of gasifier, fixed and fluidised bed suspended gasifiers. Koppa Totrek, Lurgi Winker Hygas process. Orsat gas analysis, Gobour gas and sewage gas. Syntheis gas and its uses. Underground gasification of coal.

RECOMMENDED BOOKS:

1. Fuels and combustion: Samir Sarkar.
2. Fules fumaces and Refractories: O.P.Gupta
3. An introduction to study of fuel : JC Marrae.
4. Fuels: J Francis
5. Fuels and furnaces: Brame and King
6. Fuels : Huslam & Russel.

8CT06 PROJECT & SEMINAR

SEMINAR: The Seminar Report submitted by the student at the end of VII Semester will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Chemical Technology. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination, which carries a **total of 150 marks**, will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

NOTIFICATION

No. 89/2020 Date : 26/10//2020

Subject : Implementation of new Syllabi of Semester III & IV of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester III & IV of B.E./B.Text. E./B.Tech. (Chem.Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2020-21 & onwards as per "**Appendix – A**" as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

"**Appendix – A**"

SYLLABI OF B.E. SEM. III & IV (CIVIL ENGINEERING) [C.B.C.S.]

THIRD SEMESTER

3CE01 MATHEMATICS III

Objectives:-

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Compute the partial Differential Equations.
- Understand the computational details behind certain numerical methods.
- Compute the Analytic function.
- Compute and interpret the correlation coefficient.

Course Outcomes:
After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Partial Differential Equations.
4. Compute different Numerical Methods.
5. Apply the knowledge of Complex Analysis.
6. Demonstrate the basic concepts of probability and statistics.

SECTION-A

Unit I : Ordinary Differential Equations :

Complete solution, Operator D, rules for finding the complementry function, the inverse operator, Rules for finding particular integral. Method of variation of parameters, Cauchy's and Legendre's Linear Differential equations. Simultaneous linear differential equations with constant coefficients Applications to civil engineering. (7)

UnitII: **Laplace transforms:**

Definition and elementry properties, Inverse L.T. by various methods, Convolution theorem, Solution of ordinary differential equation using Laplace transform of periodic functions. Application to problems of beams and fluids. (7)

UnitIII : **Partial DifferentialEquations :**

P.D.E. of first order and first degree of types i) f(p,q) = O ii) f(p,q,z)=0, iii) f(p,q,x,y)=O iv) f(p,q,x,y,z)=O i.e. (a) Lagrange's form Pp + Qq = R (b) Clairtut's form z=px+qy+f(p,q) v) Equations reducible to above standard types linear Homogeneous P.D.E. of nth order with constant co-efficients. (7)

SECTION-B

Unit IV: **Numerical Methods :-** (i) Solution of Algebraic and transcendal Equations by Newton Raphson method and by method of False Position.

(ii) Solution of system of linear equations by Grout's method, Gauss Seidal method and Relaxation Method.

Numerical solution of differential equations by Picard's method, Taylor's series method, Euler's method, modified Euler's method and Rungekutta forth order method. (7)

Unit V : Complex variable :

Analytic functions, C.R.conditions, Harmonic functions. harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation) (7)

Unit VI : Statistics :

Probability : Axioms, conditional probability, Baye's theorem, Mathematical Expectation and probability distributions (Binomial, Poisson and Normal). Curve fitting by method of least square only for line and parabola, Correlation, regression. (7)

TEXT BOOKS:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar. Poona Vidhyarthi Publisher
2. Higher Engineering Mathematics by B.S.Grewal. Khanna Publishers
3. Introduction to method of Numerical Analysis- S. S. Shastry, 2^{ND} Edition, PHI Pvt. Ltd.,New Delhi.

REFERENCES:

1. A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008
2. Advancing Engg. Mathematics, E.K.Kreyzig, John Wiley
3. Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI 4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

3CE02 – STRENGTH OF MATERIALS

Learning Objectives of Subject:

1. To determine theMechanica lbehavior of the body and construction materials bydetermining the stresses, strains produced by the application of loads.
2. To apply the fundamentals of simple stresses and strains.
3. To make one understand the concept of bending and its theoretical analysis.
4. To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course outcomes:

At the end of the subject the students will be able -

1. To understand the basics of material properties, stress and strain.
2. To apply knowledge of mathematics, science, for engineering applications
3. To identify, formulate, and solve engineering & real life problems
4. To design and conduct experiments, as well as to analyze and interpret action and reaction data.
5. To understand specific requirement from the component to meet desired needs within realistic constraints of safety.

SECTION – A

Unit I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

SECTION – B

Unit IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

Unit VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Books Recommended:

1. E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.
2. S.Timoshenko and O. H. Young, 'Elements of Strength of Materials', East West Press Private Ltd., New Delhi.
3. Ferdinard L. Singer, 'Strength of Materials', Harper and Row, New York.
4. Shames, I. H., 'Introduction to Solid Mechanics', Prentice Hall of India, New Delhi.
5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
6. Junnarkar, S. B., Mechanics of materials.
7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
8. Beer and Johston, Mechanics of materials, Mc-Graw Hill.
9. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd.

3CE03 – BUILDING CONSTRUCTION & ENGINEERING GEOLOGY

Learning Objectives of Subject:

1. To understand various types and components of civil structure.
2. To learn about the type of infilling material, its features and construction methodology.
3. To understand various levels in building – floor, sill, lintel, roof levels and their need.
4. To understand the need and type of vertical and horizontal circulation.
5. To make aware of knowledge and importance of rock, soil and its impact for site selection.
6. To help one to understand the reason for Earthquake and its impact on soil / rock properties.

Course outcomes:

At the end of the subject the students will be able -

1. To understand Load bearing and Frame structure.
2. To recognize various types of construction material and its suitability
3. To recognize the various levels in building and its need.
4. To know types of staircase, doors, windows and other related fixtures.
5. To recognize types of rock and minerals and its construction properties.
6. To know reason for earthquake and seismic waves.

SECTION - A

Unit I: Introduction: Definition, types of buildings as per national building code, components of buildings and their functions, Types of structure – load bearing & framed structures. Foundation: Definition and necessity, loads of foundation, Bearing Capacity soil, field methods of improving bearing capacity. Types of foundation – shallow foundation and Types of Shallow foundation.Causes of failure of foundations and precautions to be taken.

Unit II: Masonry: Classification of bricks, manufacturing of bricks, tests on bricks, properties of burnt bricks, fly ash bricks, ALC Blocks. Brick masonry construction – Technical terms, general principles, commonly used types of bonds such as stretcher, header, English bond and Flemish bond, their suitability. Formwork: Different types, their relative merits, demerits, period for removal of formwork for different members. Earthquake resistant bands in masonry- Types, location and application.

Unit III: Floors: Types of Floors – Basement floor, ground floor and upper floors, Floorfinishes – Types of flooring material, different types of floor finishes, suitability, method of construction, criteria for selection. Roofs – Flat, pitched roof, steel roof trusses – types and suitability, types of roof covering. Arches, lintels – Types and their suitability, details of R.C.C. lintels.; chajja, precast lintels arches.

SECTION - B

Unit IV: Doors: Purpose, criteria for location, size of door, door frames.; its types, methods of fixing, Types of door shutters and their suitability, Windows – Purpose, criteria for location, no., sizes; shapes of Windows, types of windows; their suitability. Ventilators – Types and their suitability. Fixtures & fastening for doors and windows. Stairs – Function, technical terms, criteria for location, types of staircases, their suitability, principle of stair layout design.

Unit V: Plastering - Necessity, types, processes of different types of plastering, defects inplastered work. Scaffolding – Purpose, types and suitability. Special Aspects of Construction – Damp proofing – causes of dampness, its effects, various methods of damp proofing.Fire proof construction –Fire protection requirements for a multistoried building. Sound proof Construction – Sound absorbents and their characteristic. Expansion & construction joints in building.

Unit VI: Introduction - Different branches of Geology and importance of Geology in CivilEngineering.Folds, faults, joints in Geology. Geological studies related to site selection for dams and reservoirs. Petrology - rock cycle, rock weathering and soil formation, study of common rock types. Earthquake Engineering - earthquake waves, causes and effects, magnitudeand intensity, earthquake zones of India.

Books Recommended:

1. Mackay W.B.: Building Construction, Vol. I, II, III, Longmans.
2. Sushil Kumar: Building Construction, Standard Publishers Distributors.
3. Singh Parbin: General & Engineering Geology.
4. Mukherjee: A Text Book of Geology.
5. TuyrellG.W.: The Principle of Petrology.
6. WadiaD.N. : Geology of India.
7. Sane L.S.: Construction Engg. ManakTalas, Mumbai.
8. National Building Code of India, 2016.
9. Punmia B.C.: Building Construction.
10. A Manual of Earthquake Resistant, Non-Engineered Construction Indian Society of Earthquake Tech.

3CE04 – TRANSPORTATION ENGINEERING

Learning Objectives of Subject:

1. To learn about basics of Road construction like surveys, alignment principles, types of roads.
2. To study and understand various road studies for safe road design principles and essential geometry.
3. To learn about various road pavements its construction and maintenance procedure.
4. To learn about railway transportation and terms related to it.
5. To learn about construction concepts of Airport runway, Apron layout , various survey and terms related to Airport Transportation.
6. To learn about Tunnels and Bridges components types and related transportation study.

Course outcomes:

At the end of the subject the students will be able –

1. To identify type of roads and its utility.
2. To understand the application of various road studies at time of survey and actual construction.
3. To design the various types of road pavements.
4. To understand rules regulations, signals , type of gauges and railway sleepers density.
5. To recognize the Airport features and design concept of components for Aero plains movement.
6. To identify types and components of Tunnels and bridges and its design components.

SECTION-A

Unit-I Highway: Road Transport characteristics, classification of Roads, Road Patterns, Alignment principles, Survey for highway.

Unit-II Geometric Design: Cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, overtaking sight distance, Horizontal alignment, curves, superelevation.

Unit-III Pavement Design and Traffic Engineering: Components of Flexible and Rigid pavement, Design factor, Traffic Characteristics, Traffic Studies, Construction and Maintenance – WBM Surface dressing, bituminous roads and construction procedure. Road parking system, traffic control devicesand 3 E's of traffic

SECTION-B

Unit-IV:Railway: Railway transportation, track sections, embankment & cutting. Points and crossing Left &right hand turnouts. Objects, Permanent way, gauges, coning of wheels, components of permanent way, Sleeper density, Rail fixtures & fastening. Rail types and functions.

Unit-V: Airport: Agencies controlling national & international aviation, various surveys to be conducted, airport site selection, Aero plane component parts, Aircraft characteristics. Airport obstructions: Zoning laws, wind rose diagram. Basic runway length and corrections, Apron layout, Aircraft parking & parking system.

Unit-VI: Tunnel and Bridges: Tunnels- necessity, types, tunnel alignment, Size and shape of tunnels, and Tunnel lining. Tunnel drainage, ventilation & lighting of tunnels. Bridge Engineering-Components, classification and identification, data collection, site selection, economic span, Estimation of flood discharge, water way, scour depth, depth of foundation, Afflux, clearance and free board, different structural form – culverts, types of foundation, abutments, piers and wing wall.

Books Recommended:
1) Khanna S.K. & Justo C.E. : Highway Engineering
2) Rao G.V. : Principles of Transportation& Highway Engg.
3) Dr.KadiyaliL.R. : Traffic Engg. & Transport Planning.
4) BindraS.P. : Principles & Practice of Bridge Engg.
5) Saxena &Arora : Railway Engineering.
6) Agrawal M.M. : Railway Engineering.
7) Khanna S.K., Arora M.G., Jain S.S. : Airport Planning & Design,
8) Srinivasan: Tunnel Engineering.
9) Shrarma S.K. : Principles, Practice & Design of Highway Engg.
10) Duggal A.K. &Puri V.P. : Laboratory Mannual in Highway Engg.

3CE05 – CONCRETE TECHNOLOGY & RCC

Learning Objectives of Subject:

1. To understand basic construction material - Cement, its property and suitability tests.
2. To learn about meaning of concrete, strength of concrete, mixing proportion and suitability test.
3. To understand meaning of RCC and its need.
4. To learn various properties of concrete and use of different admixtures.
5. To learn about special concrete materials and methods.
6. To be able to perform mix design of concrete

Course outcomes:

At the end of the subject the students will be able -

1. To know need and composition of binding material, cement.
2. To recognize concrete and RCC and will be able to perform desired test for suitability,
3. To analyze RCC Components like slab and lintels.
4. To decide and utilize the admixtures as per the need of Concrete.
5. To understand importance of mix design.

SECTION-A

Unit I: Cement: Physical properties of Portland cement, laboratory tests on cement, types of cements. Aggregate: Classification of aggregate, physical properties, bulking and moisture content, specific gravity, bulk density.

Unit II: Properties of fresh concrete: Workability of concrete, methods of measuring workability, nominal mix, mixing, centering & formwork, placing, compaction and curing of concrete. Properties of hardened concrete: Grades of concrete, properties of concrete, compressive, tensile, and shear strength, modulus of elasticity, creep, shrinkage.Durability of concrete,laboratory tests on concrete.

Unit III: Basic elastic theory and concept of reinforced concrete, types of reinforcement, Analysis of rectangular sections by working stress method, modes of failure, design of singly reinforced beams, one-way slabs (simply supported), lintels, andchajjas.

SECTION-B

Unit IV: Pozzolana and Admixtures: Plasticizer, retarders, accelerators, water proofing agents, mineral admixtures, IS code provisions. Construction chemicals: concrete curing compounds, polymer bonding agent, surface retarders, bond aid for plastering, protective and decorative coating.

Unit V: Special concrete: Ready Mix Concrete Light weight concrete, fiber reinforced concrete, Roller compacted concrete, self-compacted concrete, high strength concrete, high performance concrete, high volume fly ash concrete. Special concreting techniques: Guniting, grouting and shotcrete concrete, introduction & application of Ferrocement.

Unit VI: Introduction of mix design, factors governing mix design, IS Code method of mix design (IS: 10262 – 2019) and Ambuja method.

Books Recommended:

1. Lea, F. M. The Chemistry of Cement and Concrete, Edward Arnold (Publishers) ltd.
2. Neville, A. M.: Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks: Concrete Technology, ELBS
4. Gambhir, M. L. : Concrete Technology, Dhanpat Rai and Sons
5. Orchard D. F.: Concrete Technology, Applied Science Pub Ltd.
6. Shetty, M. S.: Concrete Technology, S. Chand
7. Varshney, R. S.: Concrete Technology, Oxford Pub. house.
8. IS: 456 – 2000,
9. IS: 10262 – 2019,,
10. Krishna Raju: Design of Concrete Mixes, Mc – Graw Hill.
11. Ambuja Cement Concrete Mix Design- Ambuja Technical Literature series 79.

3CE06 – STRENGTH OF MATERIALS – LAB

List of Practical's in Strength of Material Lab (Minimum any eight practical from the list should be performed)
1. Tension test on metals.
2. Compression test on metals.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs.

3CE07 BUILDING CONSTRUCTION & ENGINEERING GEOLOGY – LAB

List of Practical's in Building Construction & Engineering GeologyLab (Minimum any eight practical from the list should be performed)

1. Drawing of following building elements on A-2 size sheet.
    a) Paneled door, flush door, and glazed window.
    b) Steel truss with details of joints, details & support, details of fixing of roof covering.
2. Planning & drawing of a staircase for the given data. [On A-2 size sheet, Design calculations, plan & section.]
3. Preparation of foundation plan from the given line plan of a two room building [On a A-2 size sheet.]
4. Layout of the above, in field.
5. Fields visits to building under construction and its report writing including material of construction, construction processes, Human recourses required, and construction details.
6. Sketch book containing Free hand sketches of following:
Different types of foundations, Bonds in brick masonry, Types of floors. [Sections] Types of stairs. [Plans and side view], Line sketches of different types of steel roof trusses, Details of expansion joints, Details of damp proofing for basement, Fixtures & fastenings of doors & windows.
7. To determine shape and size of supplied bricks.
8. Field visit for different types of roof structures.
9. Field visit for studying building component in Load bearing and framed structure.
10. Megascopic study of silicate and non-silicate mineral, with special reference to physical properties of minerals and uses.
11. Megascopic study of the common igneous, sedimentary and metamorphic rocks, with special reference to engineering properties of rock and uses.

3CE08 TRANSPORTATION ENGINEERING – LAB

List of practicals in Transportation Engineering-Lab (Minimum eight experiments from the list should be performed)

1. Determination of Los Angeles value
2. Determination of Abrasion value of Aggregates by the use of devil machine
3. Determination of Aggregate Impact value
4. Determination of Aggregate Crushing value
5. Determination of Flakiness and Elongation Index of Aggregate.
6. Determination of Viscosity of Bituminous material
7. Determination of softening point of bituminous material.
8. Determination of ductility of bitumen.
9. Determination of marshal stability value

3CE09 CONCRETE TECHNOLOGY & RCC – LAB

List of Practicals in Concrete Technology & RCC Lab (Minimum eight practical from the list should be performed) :

1. Mix Design (Compulsory) by IS method.
2. Compulsory site visit and submission of site visit report.
3. Fineness of cement
4. Soundness of cement
5. Consistency and setting time of the cement
6. Compressive strength of cement
7. Sieve analysis of aggregate.
8. Bulking of sand (fine aggregate).
9. Silting of sand.
10. Workability by slump cone test compaction factor test
11. Admixture: Density, Compatibility Test
12. Workability by flow table method.
13. Compressive & Tensile strength of concrete.

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FOURTH SEMESTER

4CE01 BUILDING PLANNING DESIGNING & CAD

Learning Objectives of Subject:

1. To understand need of engineering drawings and methods to draw it.
2. To learn about various planning principles and able to apply on residential buildings.
3. To understand seasonal and climatic condition and corresponding provisions in structure.
4. To know regional rules regulation related to building construction.
5. To learn various types of plan – Block , Site , Line , Detail , Section etc.
6. To learn about smart buildings.

Course outcomes:

At the end of the subject the students will be able -

1. To make engineering drawings by First angle and Third angle method.
2. To apple building planning principles practically while developing projects.
3. To study the climatic conditions and decide the corresponding provision in structure.
4. To know about Bylaws, Town development authority rules and terms.
5. To draw various plans manually and computationally.

SECTION-A

Unit I: Importance of building drawing for Civil Engineering in construction & industry, estimation, Selection of scales for various drawings. Types of line and theirapplication. Methods of dimensioning in architectural drawing. Abbreviations and graphical symbols used in Civil Engineering Drawing as per IS: 962. Compare first angle and third angle method of projection. Layout of sheet for civil engineering drawing. Requirements of drawing and documents as per plan sanctioning authorities. Define FSI and TDR.

Unit II: Planning of residential building. Introduction, general principles of planning viz. aspect, prospect, roominess, privacy, grouping, circulation, ventilation, furniture requirement.

Climate of Indian and its influence on Building planning: Solar radiation, air temperature, wind, humidity, precipitation, earth & its motion, directions to their characteristics. Orientation of buildings: factors affecting orientation, sun, wind, rain. Requirement of the owner. Alternatives of building types viz. individual bungalows, semidetached houses, row houses, apartments. Provision of mezzanine floor, balconies and porches in the building. Common utilities such as parking, security, water supply, sanitation, etc. for apartments. Criteria for earthquake resistant planning of building.

Concepts of Digitized / Smart Buildings, Internet of Things (IOT) in buildings and Green Buildings, Industrialized Buildings

SECTION -B

Unit-III: Building Bye-laws and Development Control Rules for D Class Municipal Corporations in the Maharashtra State under the provisions of the Maharashtra Regional & Town Planning Act, 1966. Conversion of land to non-agricultural lands, layout for a housing project.Types of public building and their requirements, planning of public building.

Preparing line plans of different public buildings such as schools, commercial market, primary health center, workshop, college building, post-office. Free hand sketching of components of buildings and elevation features of building such as balconies, chajjas, etc.,Staircase planning & drawing.

Unit IV: Concept of line plan, working and submission drawings of the building. Details to be incorporated in the working drawing. Necessity and use of working and submission drawing. Concept of site plan, block plan and layout plan. Importance and details to be incorporated. Concept of foundation plan, importance and use. Developing working and submission drawings for load bearing and framed structures building from the given line plan(Develop plan, elevation, LHSV, RHSV, back side view, section, foundation plan, site plan and their detail). Plumbing ramp, Electric plan.

Books Recommended :

1. Shah, Kale &Patki, Building Planning & Drawing, Tata McGraw-Hill plubication
2. Dr. Kumar Swamy& Rao Swamy, Charotar publications
3. CheryR , Auto cad Pocket reference, BPB Publication.

4CE02 - HYDROLOGY & WATER RESOURCE ENGINEERING

Learning Objectives of Subject:

1. To study the different hydrological parameters.
2. To understand hydrological statistics and design.
3. To characterize and mitigate natural and man-made hazard.
4. To understand the various irrigation systems and its design.

Course outcomes:

At the end of the subject the students will be able -

1. Explain the hydrology and hydrological data.
2. To analyze the hydrological methods for runoff.
3. Evaluate the ground water hydrological problems.
4. Explain the need of irrigation systems and its alternatives.

SECTION – A

Unit I: Introduction - Hydrologic cycle, applications in engineering, sources of data. Precipitation- Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP).

Unit II: Abstractions from precipitation - evaporation process, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modeling infiltration capacity, classification of infiltration capacities, infiltration indices.

Unit III: Runoff - runoff volume, methods of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph. Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

SECTION – B

Unit IV: Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler, pipeline distribution network(PDN) and trickle / drip irrigation.

Unit V: Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Lining of canals, types of lining. Water logging problems, causes, effects and remedies.

Unit VI: Dams and spillways – Earthen dams: Classification, design considerations, selection of suitable site. Estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Economic height of dam, Spillways: components of spillways, types of gates for spillway.

Books Recommended:

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. G L Asawa, Irrigation Engineering, Wiley Eastern

4CE03 SURVEYING

Learning Objectives of Subject:

1. To learn about the term surveying, various instruments and possible error.
2. To learn Linear Measurement methods and way of conduction.
3. To learn about the measurement at elevation and of Directions , contour development process.
4. To understand and learn performing Plane table surveying.

Course Outcomes:

At the end of the course the student will be able to:

1. Define principles of Surveying, Remote Sensing and Geomatics.
2. Describe different instruments, tools, applications and techniques to determine the positions on the surface of the earth, change detection.
3. To perform Liner measurement methods of surveying.
4. Differentiate the techniques for setting out alignments, curves, other layouts, modern survey systems etc.
5. To perform survey at elevation and conduct Plane Table survey.

SECTION-A

Unit I: INTRODUCTION: Geo-informatics- definition, disciplines covered, importance. Field Surveying- definition & objectives; concept of Geoids and reference spheroids, coordinate systems, plane and geodetic surveys. Methods of location of a point- classification of surveys; principles of surveying Errors in measurements- sources, types of errors and their treatment. Random error distribution, accuracy, precision and uncertainty. Surveying instruments- temporary and permanent adjustment concept, principle of reversal. Maps- types, importance, scales/CI, conventional symbols, and generalization; topographic maps projection systems, sheet numbering systems, map layout.

Unit II:LINEAR MEASUREMENTS: Direct and indirect methods; Chain and tape measurements- corrections to tape measurements; Optical methods- tachometers, sub tense bar; Electronic methods- EDMs, total stations.

Unit III: MEASUREMENT OF ELEVATIONS :Various terms; Methods of height determination; Spirit leveling- different types of levels and staves; booking and reduction of data, classification and permissible closing error; profile leveling and cross sectioning; curvature & refraction and collimation errors; reciprocal leveling. Contours- characteristics, uses and methods of contouring.

SECTION – B

UnitIV:MEASUREMENT OF DIRECTIONS: Bearings and angles; Compass surveying- magnetic bearings, declination, local attraction errors and adjustments.

Unit V: TRAVERSING: Purpose and classification of each; Compass and theodolite traverses, theodolites- different types, uses, methods of observation and booking of data, balancing of traverses, computation of coordinates, omitted measurements Gale's traverse table.

Unit VI: PLANE TABLING: Merits and demerits, accessories; orientation and resection; methods of plane tabling; three point problem and solutions; errors in plane tabling, least square principle, Engineering project surveys- requirements and specifications, various stages of survey.

Books Recommended:

1. D. Clarke: Plane and Geodatic Surveying, Volume I & II
2. T.P. Kanetkar& Kulkarni: Surveying & Levelling, Part I & II.
3. B.C. Punmia : Surveying I & II.
4. N.N. Basak : Surveying & Levelling.

4CE04 - GEOTECHNICAL ENGINEERING –I

Learning Objectives of Subject:

1. To understand the various types of soil and its classification.
2. To learn about the Index and Engineering properties of soil.
3. To make one understand the mechanics of compaction and factors affecting the compaction.
4. To understand the concept of permeability and factors affecting to it.
5. To learn about the concept of seepeage discharge and effective, neutral and total stress in soil mass.
6. To make one understand the stress distribution in soil mass& its engineering applications.

Course Outcomes:

At the end of the subject the students will be able –

1. To determine the Index properties and Atterberg limits for soil classification.
2. To understand the mechanics of compaction and quality control in field.
3. To explain permeability of soil and methods of dewatering.
4. To calculate the seepage discharge and design the graded filter.
5. To understand the concept of consolidation and stress distribution in soil mass.
   To calculate the shear strength of different soil.

SECTION - A

Unit- I History of development of soil mechanics, formation of soil, its significance to the field problems. Soilproperties and its classification, system: Definition of soil, soil as a three phase system, weight – volume relationship Index properties of coarse and fine grained soil BIS classification of fine grained & coarse grained soil.

Unit-II Concept of clay mineral, major soil minerals, their structural formation and properties. Mechanics of compaction, factors affecting compaction, Standard and modified Proctor test, their field Determination, zero air void line, concept of wet of optimum, and dry of optimum, different structures of soil, field compaction & their control. CBR test and CBR value for soak and unsoaked conditions.

Unit-III Absorbed water, surface tension, capillarity and its effect on Soil properties permeability of soil, Darcy's law and validity, Discharge and seepage velocity, factors affection Permeability, determination of coefficient of permeability laboratory and field methods. Permeability for stratified deposits. Drainage and dewatering of soil and it's various methods.

SECTION – B

Unit-IV Laplace equation, its derivation in Cartesian co-ordinate system, its application for the computation of discharge seepage, seepage pressure, quick sand condition, concepts flow net, method to draw flow nets, characteristics and use of flow net, preliminary problem of discharge, estimation of discharge through homogenous earthen embankment, concept of effective neutral and total stress in soil mass, method of arresting seepage, design Terzaghi's criteria for graded filter, concept of piping and criteria of stability against piping.

Unit-V A physical concept of shear strength, Introduction of Mohr's stress diagram, Mohr's failure criteria, Mohr-Coulomb's theory and development of failure envelopes, Unconfined compression test, Laboratory measurement of shear strength for different drainage, conditions by direct shear test, Triaxial test for various drainage conditions, Merits and demerits of various shear strength tests. Concept of pore pressure coefficient shear characteristics of sand, NC and OC clays and partially saturated soil, Influence of soil structure and strain rate on shear strength.

Unit-VI State of stress at a point, stress distribution in soil mass, Boussinesq's theory and its applications, point load, uniformly loaded rectangular and circular area New-mark's chart, its preparation and use, equivalent point load Compression of laterally confined soil, concept of consolidation spring analogy, Terzaghi's theory of one-dimensional consolidation. e-p curve, compression index, swelling index, coefficient of compressibility, Consoledometer-test, determination of Cv Cassagrande's method for determination of pre-consolidation pressure.

Books Recommended:

1) Craig R.F.: Soil Mechanics,
2) Lambe T.W. & Whiteman R.V.: Soil Mechanics, John Wiley and Sons, 1969.
3) Terzaghi K. & Peck R.B.: Soil Mechanics in Engg. Practice, John Wiley & Sons, 1967.
4) Gulhati S.K.: Engg. Properties of Soils, Tata McGraw Hill, New Delhi, 1978.
5) Singh A.: Soil Engg. in Theory and Practice, Asia Publishing House, Mumbai.
6) Venkataramiah C.: Soil Mechanics and Foundation Engineering.
7) B. M. Das, Advanced Soil Mechanics.
8) S. K. Garg: Soil Mechanics and Foundation Engineering.

4CE05 - STRUCTURAL ANALYSIS- I

Learning Objectives of Subject:

1. To understand the action and corresponding displacement in various type of structural elements.
2. To learn about statically determinate and indeterminate structures.
3. To analyze continuous, cantilever and propped cantilever beams.
4. To learn different analysis methods for analysis of beam, frames and trusses.
5. To learn analysis of 2 Hinge and 3 Hinge arches.

Course outcomes:

At the end of the subject the students will be able -

1. To decide what is required to be analyzed depending upon type of structural element.
2. To know about degree of freedom, Condition of equilibrium and determinacy of element.
3. To understand reason for failure and permissible limits for safety.
4. To apply the knowledge of beam analysis for practical analysis and design purpose.
5. To make application of various analysis methods for actual structural member analysis and design.
6. To know merits for utilization of suspension, 2 hinged and 3 hinged arches.

SECTION – A

Unit-I : 1. Classification of Structures, Concept of statically indeterminate Structures, Analysis of fixed beam and propped cantilever, Rotation and sinking of support.

2. Analysis of Continuous beam by theorem of three moments, sinking of support.

Unit-II : 1. Castigliano's theorem I, Unit load method, slope and deflection in determinate beams and portals.

2. Deflection in determinate trusses.

Unit-III : Influence line diagrams for reactions, bending moment and shear force for determinate beams. Rolling loads on simply supported beams concentrated and uniformly distributed loads, maximum shear force and bending moment, focal length.

SECTION - B

Unit IV : 1. Analysis of Cables Suspension Bridge under Concentrated Load and UDL for Cables over pulleys and Cable provided with saddles.

2. Two & Three hinged arches subjected to static loads, Bending moment, radial shear and axial thrust.

Unit V: Slope deflection method: 1. Analysis of continuous beams with and without sinking of support.

2. Analysis of portal frames without side sway.

Unit VI : Moment Distribution method: 1. Analysis of continuous beams with and without sinking of support.

2. Analysis of portal frames without side sway.

Books Recommended:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II.
2. Jain and Arya, Theory and Analysis of Structures .
3. Reddy. C. S., Basic Structural Analysis, Tata – McGraw hill
4. Wang, C. K., Elementary Analysis of Structures
5. Norris and Wilbur, Elementary Structural analysis.

4CE06 BUILDING PLANNING DESIGNING & CAD – LAB

A. SKETCH BOOK :

1. Draw various types of lines, Graphical symbols for materials, doors, windows, sanitary and water supply installations, electrical installations, Abbreviations as per IS 962:1989, Location for bed, sofa, dining table with chairs, wardrobe, kitchen furniture, etc. Free hand sketches of Verandah, lobby, passage, corridor and balconies. Building layout plan with setback lines, sanitary and water supply lines. Loft and Mezzanine floor.

2. Collect one readymade drawing for residential building (1 BHKD or 2BHKD) Read various details shown on drawing. write summary of observations on the drawing itself such as orientation of rooms, placement of doors and windows, wall thicknesses, flooring in rooms and sanitary block, skirting, dado, kitchen platform-size, height etc; room height, chajja projections, staircase-rise, tread, landing etc. Attach these drawings with the sketch book.

3. Draw line plans for five Residential Buildings with minimum three rooms and staircase in each with WC and Bath.

4. Draw line plans for five Public Building- School Building, Primary Health Centre, Hospital Building, Bank, Post Office, Hostel, Canteen and Shopping Complex. Bar & Restaurant and Hotels, Saloon, Bus Station.

B. FULL IMPERIAL SIZE SHEET (A1)

AUTOCAD: Understanding basic concepts such as Absolute, relative & world Co-ordinates, Drawing units, drawing limits, extend, layers, line types, object snapping, and filter.

Drawing entities in AutoCAD/Felix CAD, various drawing commands, use of object snaps & filters, Editing the drawing different editing commands, Dimensioning commands, Text commands, Hatching commands viewing the drawing different views, view ports, zooming in & out, panning, saving & printing in different scales.

Draw sheet no. 1, 2 and 3 drawing in Auto-CAD or similar software.Prepare sheet no. 3 in Pre-DCR software.

1. SHEET NO. 1 : Submission drawing, **to the scale 1:100,** of single storied Load Bearing Residential Building (4 Room) with Flat Roof and staircase showing developed plan, elevation, section passing through Stair or W.C. and Bath, site plan (1:200), **foundation plan and section (1:50),** area statement, schedule of openings , construction notes.

2. SHEET NO. 2 : Submission drawing, to the scale 1:100, of (G+1) Residential Building Framed Structure (2 BHKD) with attached toilet to 1 bedroom showing the position of European type WC pan) showing developed plan, elevation, section passing through staircase, site plan (1:200), foundation plan **and section** (1:50), area statement, schedule of openings. (Also Show the place for Washing machine, WHB, Pooja, store, bed, dining table with chairs, sofa, wardrobe etc.)

3. SHEET NO. 3: Submission drawing of Apartment / Multi storeyed building to the scale 1:100, showing developed plan, elevation, section passing through staircase or W.C. and Bath and Component Drawing of RCC Lintel and Chajjas. Shows detailed enlarge section.

Note: No identical plans and every student must have his/her own plans and drawings.

4CE07 - HYDROLOGY & WATER RESOURCE ENGINEERING - LAB

TERM WORK: Five problems from the following to be worked out by the students, whenever necessary scale drawing on half empirical size must be drawn:

Practical examination shall consist of viva – voce.
1. Fixing control levels of Reservoir from given data.
2. Cross section, plan, L-section of Earth dam showing all components.
3. Drawing of elementary and practical profile of gravity dam.
4. Drawing of diversion weir on permeable foundation.
5. Drawing of ogee spillway with energy dissipaters.
6. Computer Aided design of unlined and lined canal.
7. Drawing of any four canal structure (No design)
8. Technical Field visit.

4CE08 SURVEYING– Lab

List of Practical's in Surveying Lab (Minimum eight practical from the list should be performed)

1. Distance measurement by chain tape and EDM.
2. Finding RL of given point.
3. Profile and cross section leveling for road.
4. Measurement of bearings with prismatic compass.
5. Chain and compass traversing.
6. Local attraction detection- correction of bearings.
7. Measurement of Horizontal and Vertical angles using Theodolite.
8. Theodolite Traversing.
9. Plane table surveying- Radiation, Intersection and Resection method.
10. Engineering Project Surveys.

4CE9 GEOTECHNICAL ENGINEERING I – LAB

List of Practical's in Geotechnical Engineering- I Lab (minimum eight practical from the list should be performed)

Experiments:

1. Determination of specific gravity of soil solids by Pyconometer, density bottle.
2. Determination of moisture content by ovendrying method.

3. Determination of field density of the soil by sand replacement / core cutter method.
4. Determination of grain size distribution by mechanical sieve analysis.
5. Determination of Atterbergs limits (LL, PL and SL)
6. Determination of Compaction properties (Standard Proctor Test)
7. Determination of permeability of soil by using falling head test
8. Determination of shear strength parameters by direct shear test
9. Determination of unconfined compressive strength of soil.
10. Determination of shear strength parameters by Triaxial list of UU type
11. C.B.R. test. Determination of C.B.R. value by conducting CBR test on soaked sample.
12. Determination of Coefficient of consolidation by conducting consolidation.

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SYLLABUS OF B.E. [MECH.] SEM. III & IV {C.B.C.S.}

Semester-III

3ME01 MATHEMATICS-III

Course Learning Objectives :

1. To provide the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. To understand the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. To provide knowledge to apply False Position, Newton Raphson method to solve nonlinear & polynomial equations, Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. To understand the Gradient, divergent and curl of vector point functions. To find the directional derivatives of scalar point functions. To discuss the Irrotational and solenoidal vector fields. To define line surface and volume integrals.

Course Outcomes :

Students will be able to -

1. Demonstrate the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. Define the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. Apply False Position, Newton Raphson method to solve nonlinear & polynomial equations Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. Define Gradient, divergent and curl of vector point functions. Finds the directional derivatives of scalar point functions. Discuss the Irrotational and solenoidal vector fields. Define line surface and volume integrals

SECTION-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (10 Hrs)

UNIT-II: Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations. (10 Hrs)

UNIT-III :a) Partial differential equation of first order of following form- (i) $f(p,q)=0$; (ii) $f(p,q,z)=0$; (iii) $f(x,p)=g(y,q)$; (iv) $Pp+Qq=R$ (Lagranges form); (v) $z=px+qy+f(p,q)$ (Clairaut form)
b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, Regression.
c) Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (10 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation), singular points, expansion of function in Tayler's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (12 Hrs.)

UNIT-V: Numerical Analysis : Solution of algebric and transcendental equations by Newton-Raphson method & method of false position. Solution of system of linear equations by Gauss-Seidal method, Relaxation method. Solution of first order ordinary differential equations by Picard's, modified Euler's, Runge-Kutta and Taylor's method. (10 Hrs.)

UNIT-VI: Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (10 Hrs.)

Books Recommended :-

Text Books:

1. Text book on Applied Engineering Mathematics, Vol. II, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
2. Higher Engineering Mathematics, B.S Grewal, Himalaya Publishing House.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Book : Advanced Engineering Mathematics, Erwin Kreyzig, John Wiley.

3ME02 MANUFACTURING PROCESSES

Course Learning Objectives :

1. To study the manufacturing processes in sand casting industries, tooling and equipment
2. To study the metal melting process, melting furnaces and defects in casting
3. To study the various types of casting processes
4. To study the mechanical working of metals and allied processes
5. To study the mechanical joining processes and fastenings
6. To study welding processes and surface treatment processes

Course Outcomes :

Students will understand the :

1. basic concept of foundry process and related activities
2. concept of complete sand casting process with advance casting methods
3. fundamentals of welding processes
4. various processes like electroplating, anodizing etc and their importance in industries

SECTION- A

Unit-I : Introduction to manufacturing processes & classification; Introduction to pattern making Pattern materials, pattern making tools, allowances, Types of patterns, functions of patterns, General properties of moulding sands, Mold hardness. Preparation of sand moulds of different types, Moulding processes, core making, core prints, core boxes. Sand casting Processes - Basic principle and Terminology of sand casting, design of gating and riser system – by numerical approach. (9Hrs)

Unit-II : Technology of melting and casting - Melting furnaces, crucibles, pit, open hearth, gas fired cupola, cupola operation and electric hearth furnaces, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace.

Defects in castings and its types, Causes and remedies of casting defects. Origin and classification of defects, shaping faults, Inclusion and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Inspection and testing of castings:- Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test. (7 Hrs)

Unit III: Casting processes and their principle of operation and applications permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods, cleaning of castings, Modernisation & Mechanisation of Foundries. (8 Hrs)

SECTION – B

Unit IV: Mechanical working of metals: Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, load estimation for bulk forming (forging and drawing), rolling and types of rolling mills. (8 Hrs)

Unit V: Joining processes:- Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing Welding, Types of welding processes-Arc welding: principle and working, Gas welding- principle and working Types and purpose of Electrodes, Electrode coatings(flux). TIG & MIG processes – Working principles and its applications, shielding gases, MIG-Spray transfer and dip transfer processes. (6 Hrs.)

Unit VI: Submerged arc welding & resistance welding :- Heat generation in resistance welding, operational characteristics of resistance welding processes such as spot welding, projection welding, butt welding.
Principle of operation of friction welding, forge welding, plasma arc, thermit welding. Welding defects, Testing and Inspection of welds, Ultrasonic, Electroslag, Electron Beam, laser welding, weldability.
Surface Treatment-Electroplating, electroforming, and iodising, metal spraying, shot peening, polishing, mechanical cleaning. (9 Hrs)

Books Recommended :

Text Books:-

1. Workshop Technology Vol. I by Bawa, Tata Mc-Graw Hill Publication.
2. Workshop Technology Vol I by Hajra Chaudhary, Dhanpat Rai & Sons 2001.

References:-

1. Workshop Technology Vol I by Raghuwanshi.
2. Manufacturing Processes by J.P. Kaushish; PHI
3. Processes and Materials of Manufacture by R.A.Lindberg, PHI Pub 2001.
4. Manufacturing technology Vol. I, by P. N. Rao.

3ME07 MANUFACTURING PROCESSES - LAB

Practices:-

1. Study of safety precautions in workshop practices.
2. Foundary:- Any two of the following jobs Sand preparation and practice in moulding of various types of patterns:- Pattern making - one job, Moulding - one job Casting - one job.
3. Joining Processes :Two composite jobs involving electric welding, gas welding and resistance welding process.
4. One job on Mechanical Working of Metals like piercing / drawing / bending/ embossing/ spinning/ upsetting, etc.

A journal should be prepared and submitted on above term work.

The practical examination shall consist of a job preparation and college assessment should be based upon the jobs, term work and viva examination.

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3ME03 MECHANICS OF MATERIALS

Course Learning Objectives :

1. To develop theoretical basis for stress, strain concept in various components under study
2. To study mechanical behavior of engineering material
3. To familiarize about finding shear force, bending moment, torsion, slope and deflection of various types of beams with different loading conditions
4. To build the necessary background to apply the knowledge of mechanics of materials on engineering applications

Course Outcomes :

Students will be able to -

1. Determine the stress & strain in the member subjected to axial, bending & torsional load
2. To observe different types of material behavior such as elastic, plastic, ductile and brittle
3. Apply SF and BM diagrams to analyse resistance offered by the beam and able to solve practical problems in real world
4. Apply deflection criteria to check the stability of beam

SECTION-A

Unit-I: 1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety, stress and strain of bar due to self weight.

2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only, introduction to theory of elasticity and photoelasticity. (10 Hrs.)

Unit-II: 1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.

2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs. (7 Hrs.)

Unit-III: 1.Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.

2. Shear stress distribution on beam rectangular and circular cross sections. (7 Hrs.)

SECTION – B

Unit-IV: Thin and thick cylinders and thin spherical shells subjected to internal pressures. (4 Hrs.)

Unit –V: 1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.
3. Strain energy and resilience : proof resilience, shear resilience, strain energy due to self load (7 Hrs.)

Unit-VI: Deflection in simply supported beam, cantilever beam subjected to point loads, uniformly distributed loads, moments by Macauley's method. (7 Hrs.)

Books Recommended:

Text Books :
1. Ramamruthm : Strength of Materials, Danpat Rai and Sons, New Delhi .
2. R. S. Khurmi: Strength of Material, S. Chand Publication, Delhi.

Reference Books :
1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material : A Practical Approach, University Press, Hyderabad.

3ME08 MECHANICS OF MATERIALS - LAB

Practicals:
Minimum Six to Eight out of the following:
1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

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3ME04 ENGINEERING THERMODYNAMICS

Course Learning Objectives :
1. To study the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. To study the laws of thermodynamics and their applications
3. To study the properties of steam, work done and concept of heat transfer
4. To study the air standard cycles

Course Outcomes :
Students will be able to
1. Understand the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. Apply first law of thermodynamics and application of first law to flow and non-flow processes
3. Apply second law of thermodynamics and understand concept of entropy
4. Understand the properties of steam, work done and heat transfer during various thermodynamics processes with steam as working fluid
5. Understand the concept of air standard cycles

SECTION – A

Unit-I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant.
Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams (10 hrs)

Unit-II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Application of first law to non-flow processes, Change in internal energy, work done and Heat transfer during various non-flow processes. (7 hrs)

Unit-III: First Law applied to flow processes: Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9 hrs)

SECTION – B

Unit-IV: Second Law of thermodynamics: Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Plank and Clausious statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem and its corollary, The thermodynamic temperature scale, Reverse Carnot cycle, Inequality of Clausius. Introduction to Entropy, availability and irreversibility. Principle of increase of entropy. (8Hrs)

Unit-V: Properties of Steam: Triple point and critical point, Sensible heat, latent heat, superheat and total heat of steam. Wet steam, dryness fraction, Internal energy of steam, External work of evaporation, internal latent hear, Specific volume, enthalpy, internal energy and entropy of steam. T-S diagram Mollier chart, Steam tables and their use. Work done and heat transfer during various thermodynamics processes with steam as working fluid. Throttling of steam, determination of dryness fraction using various calorimeters. (8 Hrs)

Unit VI : Air Standard Cycles: Ottto, diesel, semidiesel, Brayton, Sterling and joule cycles etc., their efficiencies and mean effective pressure, comparison of auto, diesel and duel cycles.
Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. (No numerical on this unit) (numerical on air standard cycle) (8 Hrs)

BOOKS RECOMMENDED:

Text Books :

1. Engineering Thermodynamic - by P. K. Nag.
2. Fundamentals of Engineering Thermodynamics; R. Yadav;
3. Thermodynamics Basics and Applied: by V. Ganeshan
4. Thermal Engineerirng: by Mahesh M. Rathore.

Reference Books :

1. Basic Engineering Thermodynamics - by Reyner Joel
2. Thermodynamics - by C.P. Arora.
3. Fundamentals of Classical Thermodynamics - by G. J.Vanwylen.
4. Engineering Thermodynamics; P. Chattopadhyay; Oxford
5. Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson.

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3ME05 FLUID MECHANICS

Course Learning Objectives :

1. To introduce and explain the fundamentals of Fluid Mechanics used in applications of Hydraulics, Aerodynamics, Gas dynamics, etc.
2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To inculcate the importance of boundary layer flow and its applications
6. To determine the losses in a flow system, flow through pipes, impact of jet

Course Outcomes :

The student will be able to:

1. identify importance of various fluid properties at rest and in motion
2. derive and apply general governing equations for various fluid flows
3. understand the concept of boundary layer theory and flow separation.
4. calculate energy losses in pipe flow.
5. evaluate the performance characteristics of hydraulic jets

SECTION – A

UNIT-I : 1. Basic properties of fluid such as Density, Specific weight, Specific Volume, Specific gravity, Viscocity of fluid, Surface Tension, Capilarity, vapour pressure & cavitation.

2. pressure & its measurement: Pascals law, Hydrostatic law of pressure & pressure variation in fluid, measurement of pressure by Manometer. (10 Hours)

UNIT-II : 1. Hydrostatic pressure force on plane & curved surfaces. Measurment of total pressure & centre of pressure.

2. Buoyancy & floatation: Concept of buoyancy, centre of buoyancy. Stability of floating body, Metacentre & metacentric height. Condition of equilibrium of floating & sub-merged body. (08 Hours)

UNIT III : 1. Kinematics of fluid flow, Methods of describing fluid motion, Types of flow, rate of flow, streamline, potential line, flow net, velocity & acceleration, continuity equation in three dimensional flow.

2. Dynamics of fluid flow : Eulers equation of motion, Bernoullis equation measurement of fluid flow with venture meter. (08 Hours)

UNIT-IV : Flow through pipes: Losses in pipe, major losses, Darcy's Weisbach equation, monor losses due to sudden enlargement, contraction, entry, exit & pipe fitting. Hydraulic gradient & total energy line, flow through series & parallel pipes, concept of water hammer in pipes. (08 Hours)

UNIT-V : Motion of viscous fluid: Introduction to Laminar & Turbulent flow, Concept of Boundary layer & its type. Drag & Lift force on object. Boundary layer separation, Reynolds number & its significance. (08 Hours)

UNIT-VI : Principal of fluid machinery : Force exerted by fluid jet on plane, curved, stationary & moving vanes. Velocity diagrams, work done & efficiency. (08 Hours)

Books Recommended :-

Text Books:-

1. Fluid Mechanics & Machinery by Modi & Sheth.
2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal.
3. Engineering fluid Mechanics by R. K. Rajput.
4. Fluid mechanics & Machinery by CRSP. Ojha, R. Berndtsson.
5. Fluid Mechanics by Strecter; Tata Macgraw Hill.

Reference Books:-

1. R.K.Rajput; Engineering Fluid Mechanics; S. Chand publications.
2. Dr. Mody & Seth; Hydraulics and Fluid Mechanics; Standard book house
3. S. Ramamrutham, Hydraulic, Fluid Mechanics & Fluid Machines, Dhanpatrai publishing company.
4. Strecter, Fluid Mechanics, Tata Mc-Graw Hill.

3ME09 FLUID MECHANICS - LAB

Practical Term Work:-

At least six (6) practicals (study/Trials) based on above syllabus, as given below shall be performed and a report there of submitted by the students :

1. Measurement of fluid pressure by manometer.
2. Determination of metacentric height.
3. Verification of Bernoulli's equation.
4. Determination of co-efficient discharge by Venturimeter.
5. Calculation of Reynolds number for Laminar & Turbulent flow.
6. Determination of co-efficient of friction (Major losses in Pipes) through pipe.
7. Determination of head loss due to sudden enlargement.
8. Determination of head loss due to sudden contraction.
9. Determination of loss of head in bends & in elbows.
10. Verification of momentum equation.

Note :- Practical examination shall consist of oral or Experimentation based on above term work.

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3ME10 Machine Drawing - Lab

Course Learning Objectives :

1. To study the techniques of sectioning and visualizing the objects
2. To imagine and develop the missing views of objects
3. To seek the knowledge of development of surfaces
4. To seek the knowledge of intersection of solid objects
5. To know the conventions for materials and parts used in industries
6. To prepare the drawings for machine assembly

Course Outcomes :

Student will be able to -

1. Demonstrate the techniques of sectioning and visualizing the objects
2. Imagine, understand and sketch the missing views
3. Develop surfaces of objects and apply knowledge during their fabrication
4. Understand the concept of intersection of solid objects
5. Understand and apply the conventions for materials and parts used in industries
6. Prepare detail machine assembly drawings

List of Practicals :

1. Conversion of pictorial view into Sectional Orthographic Projection
2. Missing Views
3. Development of surfaces of Cubes / Prisms / Cylinders / Pyramids / Cones & their cut sections
4. Intersections of Solids – Prism & Prism /Cylinder & Cylinder /Cylinder & Prism / Cone & Prism
5. Conventions for various materials & parts
6. Preparation of detail drawings of simple machine assembly
7. Preparation of assembly drawing of simple machines

Books recommended:

Text Books:

1. Engineering drawing by N.D. Bhatt; Charactor Publications.
2. Machine Drawing by A. M. Bisen; New Edge International publication.
3. Machine Drawing by R. K. Dhawan, S. Chand
4. Machine Drawing by Basant Agrawal, McGraw Hill.
5.

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B.E. (MECHANICAL) SEMESTER FOURTH

4ME01 MATERIAL SCIENCE

Course Learning Objectives:

1. To study the basic concepts of metallurgy and classification of materials
2. To study the process of formation of microstructures of metal materials and composites
3. To study the alloying elements, their effects and applications
4. To study the ferrous and non-ferrous metals and respective alloys
5. To study the various heat treatment processes and their industrial applications
6. To study the mechanical working of metals and process of powder metallurgy

Course Outcomes:

Students will understand the -

1. Basic concepts of metallurgy and types of materials.
2. Iron-Carbon Equilibrium Diagram, critical temperatures, formation of microstructures and they will get the knowledge of alloys.
3. Uses and practical applications of ferrous & non ferrous materials
4. Various heat treatment processes, powder metallurgy and industrial applications.

SECTION - A

UNIT-I: Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation, lever rule for phase mixtures. Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification. (8 Hrs)

UNIT II: Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Microstructure of slowly cooled steel, Estimation of carbon from microstructure, structure property relation, Introduction to composite materials, advantages and applications. (8 Hrs)

UNIT III: **Alloy Steels:** Purpose of alloying, Classification of alloy steels, classification of alloying elements, Effect of alloying elements on eutectoid composition, Eutectoid temperature, and on the S curve, , alloying elements and their effect on properties of steels, OHNS steels, Hadfield'S Manganese steels, High speed steels, their heat treatments and applications, Ferritic, Austenitic and Martensitic stainless steels, their properties and applications, weld decay in stainless steel. (8 Hrs)

` **SECTION - B**

UNIT IV: Cast irons **:** Factors governing condition of carbon in cast iron, Maurer's diagram, Solidification of grey and white cast iron, Malleabalizing, Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.

Non Ferrous Metals and Alloys : Types, Properties and uses of Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (8 Hrs)

UNIT V: Principles of Heat Treatment: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on 's' Curve, pearlite, bainite and martenste transformation, Quenching media, severity of quench, Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability. (8 Hrs)

UNIT VI: Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening. Mechanical working of Metals: - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve, Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth. Metallurgical factors affecting various Mechanical working processes, preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.

Powder Metallurgy: Concept, Methods of Manufacture of metal powders, compaction Process- Single die and double die, sintering, stages of sintering, Manufacture of porous bearings & cemented carbide tip tools by P.M.T. Advantages, limitations and applications of powder metallurgy. (8 Hrs)

BOOK RECOMMENDED :-

Text Books :-

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Grawhill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material nScience & Mettalurgy, by V.D. Kodgire. Everest Publication House.

Reference Books:

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn.,1987.
3. Power metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication.

4ME07 MATERIAL SCIENCE - LAB

List of Practicals: - (At least eight (8) practicals out of the following list.)

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalized plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of non ferrous metals.(brasses, bronzes)
8. Study of micro structures of hardened and tempered steels.
9. Study of Iron carbon Equilibrium diagram & Allotropic forms of iron.

10. Study different Heat Treatment Process for steel.
11. Study of different surface Hardening processes for steels.
12. Study of effect of alloying elements on the properties of steels.
13. Measurement of hardenability by Jominy end quench test apparatus.
14. Study of hardness tester and conversion of Hardness number
15. Industrial visit to study heat treatment plant.
16. Measurement of particle size, grain size, nodularity, coating thickness etc. by using some software like Metzer Microcam 4.0

Practical Examination:
Note : Practical examination shall consist of viva voce/performance based on the above syllabus and practical work.

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4ME02 ENERGY CONVERSION - I

Course Learning Objectives:
1. To study the properties of steam and its behavior for different thermodynamic process.
2. To study different types of boilers, their mountings, accessories, performance of boilers and different efficiencies.
3. To study the various fuel handling and ash handling system in power plant.
4. To study various types of condensers and cooling towers.
5. To study various thermodynamic aspects of flow of steam through nozzle and diffuser.
6. To study flow of steam through steam turbine and concept of compounding.

Course Outcomes:
1. Students will study the concept steam and steam power plant, mounting and accessories.
2. Students will demonstrate the calculation of various efficiency & related parameters.
3. Student will show the adequate knowledge of fuel & ash handling systems.
4. Students will demonstrate the knowledge of condenser & application.
5. Students will understand the concepts of steam nozzles & steam turbine.

SECTION – A

Unit I : Flow diagram for steam power plant with basic units such as steam generator, turbine, condenser and pump. Steam power plant layout, site selection. Boilers: Introduction to water tube and fire tube boilers used in thermal power plants, packaged Boilers, High pressure boilers; Loeffler, Benson, Lamont Boilers, Boiler mountings and accessories—devices for improving Boiler efficiency. Principle of fluidized bed combustion. Concept of co-generation. (7 Hrs.)

Unit II : Boiler draught; Types of draught, expression for diameter & height of chimney, condition for maximum discharge, efficiency of chimney, reasons for draught loss. Boiler performance:- Boiler rating, boiler power, equivalent evaporation, efficiency. Effect of accessories on boiler efficiency and heat balance. (7 Hrs)

Unit III : CONDENSERS : Need, Types of condensers, quantity of cooling water required. Dalton's law of partial pressure, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance. cooling towers: Natural and mechanical wet type cooling tower.

Steam nozzles : Flow of steam through nozzles & diffusers, Maximum discharge, critical pressure ratio, chocking in nozzles, Effect of friction. Determination of throat & exit areas, Nozzle efficiency, no numerical on concept of super saturated flow & Wilson line. (7 Hrs.)

SECTION – B

UNIT IV : Steam Turbines:- Principle of working, Types of steam turbines such as impulse, reaction, axial & radial flow, back pressure & condensing turbines. Compounding. Reheat, regenerative cycles, bleeding. Analysis limited to two stages only. Analysis of steam Turbines : Flow of steam through impulse & impulse reaction turbine blades, Velocity diagrams. Graphical & analytical methods for work & power developed, axial thrust and efficiency. Height of turbine blades. losses in steam turbines:- blade friction, partial admission, disc friction, gland leakage losses and velocity losses. Governing of steam turbines. (7Hrs)

UNIT V : NUCLEAR POWER:- Fusion, fission, Chain reaction, conversion and breeding in nuclear fission. Components of Nuclear Power Plant such as Reactor, Steam generator, turbine, Moderator, Control Rods etc., Types of nuclear reactors like BWR, PWR, CANDU and liquidized metal cooled thermal reactors. (7 Hrs.)

UNIT VI : Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, MHD, Geothermal, OTEC, tidal power plants, Applications of Non conventional energy. (7 Hours)

RECOMMENDED BOOKS:

Text books :

1. Thermal engineering; Mahesh M Rathore; Tata McGraw-Hill
2. Thermal Engineering R.Yadav; Central publication
3. Non-conventional Energy Sources B. H. Khan Tata McGraw-Hill
4. Non-conventional Energy Sources G. D. Rai.

Reference books:

1. Steam Turbine; Kearton; Oscar Publications.
2. Thermal Power Engineering; Mathur Mehta; Tata McGraw-Hill
3. Power Plant Engineeirng. P. K. Nag
4. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications
5. Thermal Engineering, P.L.Ballaney; Laxmi Publications.

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4ME03 MANUFACTURING TECHNOLOGY

Course Learning Objectives :

1. To study the mechanics of metal cutting, tool characteristics and cutting forces
2. To study the turning operations using lathe and CNC machines
3. To study the working of drilling and boring machines
4. To study the working of milling and gear cutting machines
5. To study the machining operations using grinding, shaper, planer and slotter machines
6. To study the unconventional machining processes

Course Outcomes :

Students will be able to -

1. Apply the knowledge of theory of metal cutting, tool selection & calculate cutting forces
2. Demonstrate the knowledge of basics of turning operations
3. Understand the drilling and boring operations and working of drilling & boring machines
4. Understand the milling and gear cutting operations and working of respective machines
5. Understand the working of grinding, shaper, planer and slotter machines
6. Understand the knowledge of unconventional machining processes

SECTION – A

UNIT I : Theory of Metal cutting: Mechanics of Metal cutting, Tool material, Tool Geometry, Cutting tool classification, Tool life, Tool wear, Calculation of Cutting forces, Machinability, Cutting fluids, Chip thickness ratio, Merchant circle. (8 Hrs)

UNIT II : Construction, Operations and accessories of centre lathe, introduction of capstan & turret lathe, indexing mechanism, bar feeding mechanism, Machine tool classification. Numerical approach. Taper turning & Screw cutting & basic concept of CNC. Introduction, working principal & CNC turning operation. (10 Hrs)

UNIT III : a) Drilling operation : Drilling M/cs general purpose, Mass production and special purpose drilling M/cs.
b) Introduction & types of Boring. Boring M/c :- Horizontal, Vertical and jig Boring M/c. Introduction to Broaching and its types, broach terminologies, etc. (8 Hrs)

SECTION - B

UNIT IV : (a) Calculation of machining time for Milling.
(b)Milling M/c :- Types, Types of Milling Cutters, Dividing head, Compound and differential idexing.
c) Gear producing M/cs. (6 Hrs)

UNIT V : a)Grinding Machines: Bench grinders, surface grinders, centreles grinders, types of bonds & Abrasive modification of grinding wheels.
b) Study of various part & Operation of Shaper, Planer, Slotter. (6 Hrs)

UNIT VI : Unconventional Machining Processes:-

a) Mechanical Processes:- Ultrasonic Machining - principle and applications. process parameters; Abrasive and water parameters involved.
b) Thermal processes:- Election Beam Machining – Generation of beam, principle and applications : Laser Beam machining applications : Plasma-arc machining- Concept and generation of plasma, principle of PAM, applications.

c) Electric discharge Machining - Types die-sinking, wire cut EDM, Mechanism of material removal, process parameters, advantages and applications. (8 Hrs)

BOOKS RECOMMENDED :

Text Books:

1. Manufacturing Technology-Vol 1 & 2; R.L.Timings, S.P. Wilkinson; Pearson Publication.
2. Workshop Technology - By Hajra Choudhaury Vol II.
3. Manufacturing Technology Vol. II P. N. Rao, McGraw Hill Publication

References:-

1. Pandya & Shah, Modern Machining process, Tata McGraw Hill 1998.
2. Workshop Technology, O.P. Khanna, Dhanpatrai & Sons.
3. Workshop Technology - By Raghuwanshi. Vol II.

4ME08 MANUFACTURING TECHNOLOGY - LAB

Practicals:-

1. Demonstration of operations related to lathe, shaper, slotter, drilling & grinding m/cs.
2. One job on lathe covering taper turning and threading.
3. One job on shaping covering plane and inclined surfaces.

The above jobs should include drilling, grinding, tapping etc. Term work should be submitted in the form of journal.

N.B. :- The practical examination shall consists of preparation of practical jobs and assessment by external and internal examiner.

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4ME04 BASIC ELECTRICAL DRIVES AND CONTROL

Course Learning Objectives :

1. To study the working of electrical drives and their components
2. To study the basics of DC motors and their characteristics
3. To study the working of AC motors, Induction motors and concept of braking
4. To study the different speed control methods of A.C. and D.C. motors
5. To study and design of transducers and their applications
6. To study the industrial applications of different drives

Course Outcomes :

Students will be able to -

1. Understand the working of electrical drives and their components
2. Understand the basics of DC motors and their characteristics
3. Understand the working of AC motors, induction motors and concept of braking
4. Understand the different speed control methods of A.C. and D.C. motors
5. Understand the design of transducers and their applications
6. Understand the industrial applications of different drives

SECTION-A

Unit I : Concept of general electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Introduction to mechatronics, Theory and principle of Power Transistor, SCR. (8 Hrs)

Unit II : Basic characteristics of D.C. motor, Torque equation, Modified speed – Torque characteristics. Starting and braking of Electrical D.C. motors, comparison of mechanical and electrical braking methods. Introduction, Principle, construction and working of Servo motors, stepper motors, Brushless D.C. motors. (8 Hrs)

Unit III : Classification of A.C. motors, construction, types, principle of working and characteristics of 3 phase Induction motors, applications. Starting and braking of 3 phase induction motors. Classification of single phase induction motors. construction, principle and working and applications. Principle and working of universal motor. (8 Hours)

SECTION-B

Unit IV : Conventional methods of speed control of A.C. and D.C. motors. Thyristorized stator voltage control of 3 phase induction motor, (v/f) control method, slip-power recovery scheme. Thyristorized armature voltage control of D.C. motors using phase control & Thyristorized chopper. (8 Hours)

Unit V : Basic principle, construction & applications of sensors and transducers, contact - non- contact type, optical proximity sensors. Switches, contact type, magnet type, electromagnetic type, sound, light, pressure, vibration transducers, Hall effect-sensors A.C./D.C. Tachogenerators. (8 Hours)

Unit VI: Industrial applications - classes of duty selection of an electric drive for particular applications such as steel mill, paper mill, cement mill, textile mill, sugar mill, electric traction, coal mining, etc. Induction heating, surface hardening & Dielectric heating. **(8 Hours)**

BOOKS RECOMMENDED :

Text Books:
1. A First Course on Electrical Drives - S.K. Pillai.
2. Basic Electrical Technology (Vol. 11) - B.L. Theraja

Reference Books :
1. Drives and Control - N. Dutta
2. Mechatronics - W. Bolton, Addison Wesley, Longman Ltd.
3. A Course in Electrical, Electronics Measurement and Instrumentation, By A.K.Sawhney, Dhanpat Rai & Sons,

4ME09 BASIC ELECTRICAL DRIVES AND CONTROL - LAB

List of Experiments :

Any EIGHT practicals from the following list :

1. To study the Specification of Various Electrical Machines.
2. To study the D.C. Motor Starters.
3. To study the Running and Reversing of D.C. Motor.
4. Speed Measurements using Magnetic Pick-up.
5. To study the Speed reversal of counter Current Breaking of 3-phase Induction Motor.
6. To control the speed of D.C. Motor by a) Armature Control b) Field Control.
7. To perform Load Test on Induction Motor.
8. To study Dynamic/Rheostatic Breaking of D.C. Motor.
9. To study Characteristics of Thyristor.
10. To study the speed -Torque Characteristic of Servo Motor.

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4ME05 HYDRAULIC AND PNEUMATIC SYSTEMS

Course Learning Objectives:

1. To get fundamental background about the hydroelectric power plants
2. To study operation, working principle & performance characteristics of hydraulic turbines
3. To study operation, working principle & performance characteristics of centrifugal pump, reciprocating pump and other hydraulic pumps
4. To study the behavior of compressible fluid flow
5. To study different hydrostatic & hydro kinematics industrial applications

Course Outcomes:

Students will be able to -
1. Demonstrate basic concepts of prime movers and turbines
2. Utilize the knowledge of centrifugal and reciprocating pumps for applications
3. Reveal the importance of other water lifting devices
4. Solve the elementary treatment on compressible fluid flow
5. Understand the concept of hydrostatic and hydrokinetic systems
6. Use the knowledge of hydraulics & pneumatics in developing project work.

SECTION - A

Unit I : Hydraulic Turbines - Theory of impulse and reaction turbines. Pelton, Francis and Kaplan turbines, their construction, classification, analysis, characteristics and governing, draft tube. (10 Hours)

Unit II : Centrifugal pumps :- Basic Theory, classification, construction, operation, characteristics, multistage, NPSH and cavitations in pumps. (7 Hours)

Unit III:

1. Axial flow pump :- Basic theory, construction, & operation.
2. Other water lifting devices :- (a) Air lift pump. (b) Jet Pump. (c) Hydraulic Ram.
3. Computational Fluid Dynamics (CFD)
4. Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications (6 Hours)

SECTION - B

Unit IV : Positive Displacement and other Pumps: Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels. Comparison of centrifugal and reciprocating pumps, performance characteristics. (9 Hours)

Unit V : Compressible fluid flow :- Perfect gas relationship, speed of sound wave, mach number, Isothermal and isotropic flows, shock waves. (8 Hours)

Unit VI : Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic coupling, hydraulic torque converter. (8 Hours)

BOOKS RECOMMENDED :-

Text Books:-

1. CSP Ojha, R. Berndtsson, Fluid mechanics and machinery; Oxford University.
2. Bansal R.K., Fluid mechanics and fluid machines; Laxmi publications.

Reference Books:-

1. Jagdish Lal, Hydraulic machines; Metropolitan Book Co. Pvt. Ltd.
2. Dr. Modi & Seth, Hydraulics and Fluid Mechanics; Standard house book.
3. Sen gupta, Computational fluid dynamics; Pearson Publishers.
4. Sameer sheikh, Iliyas Khan, Treaties on Hydraulics; Pneumatics, R.K. Publication.

4ME10 HYDRAULIC & PNEUMATIC SYSTEMS - LAB

List of Practicals:- At least **SIX** (6) practicals based on following :

1) Trial/Study of Pelton wheel
2) Trial/Study of Francis Turbine
3) Trial/Study of Kaplan Turbine
4) Trial/Study of centrifugal pump
5) Trial/Study of reciprocating pump
6) Trial/Study of axial flow pump
7) Trial/Study of hydraulic ram
8) Trial/Study of multistage pump
9) Trial/Study of special pumps (air lift pump/ jet pump)
10) Trial/Study of Gear pump
10) Any one practical based on CFD software

Note : Practical Examination : Practical examination shall consist of Viva Voce/performance based on above syllabus & practical work.

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SYLLABUS OF SEM. III & IV B.E. (ELECTRONICS & TELECOMMUNICATION ENGG.)

Semester-III

3ETC1 - ENGINEERING MATHEMATICS-III

Course Requisite: 1. (IA1) Engineering Mathematics-I 2. (IB1) Engineering Mathematics-II

Course Objectives:

1. To deal with linear differential equations.
2. Understand Laplace transforms .
3. Introduction to geometry of curves, two and three-dimensional regions and calculus of vector valued functions.
4. To equip students with necessary knowledge and skills to enable them to handle mathematical operations of complex analysis .

5. . Understand the computational details behind certain numerical methods and their convergence.
6. To deal with system of differential and difference equations in the study of electrical/electronic and systems.

Outcomes: After successfully completing the course, the students will be able to

1 . Demonstrate the knowledge of differential equations to solve engineering problems of analog systems.
2 . Apply Laplace transform to solve differential equations.
3. Apply knowledge of vector calculus.
4. Comprehend knowledge of complex analysis in terms of complex variables, harmonic functions and conformal mapping.
5. Apply numerical methods to obtain approximate solutions to mathematical problems.
6. Identify and solve certain forms of partial difference equations as applied to discrete systems.

SECTION - A

Unit-I : Ordinary Differential Equations: - Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7)

Unit-II: Laplace transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Solution of linear differential equations using Laplace transform. (7)

Unit III : Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), irrotational and solenoidal vector fields. Fourier transforms: Fourier sine and Fourier cosine transforms and integrals . (7)

SECTION- B

Unit IV : Complex Analysis: - Functions of complex variables, Analytic function, CauchyReimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method. Conformal Mappings: Translation, Rotation, Magnification, Inversion and Bilinear Transformation, expansion of function in Taylor's and Laurent's series. (7)

Unit V : Numerical Methods: Solution of Nonlinear and Polynomial Equations : False Position, Newton Raphson Method. Solution of Linear Systems Equations: Gauss Elimination method, Gauss Seidel Iterative Method, Relaxation method Solution of Differential Equations: Euler's method, Runge-Kutta method, Picards method. (7)

Unit VI : (a) Difference Equation:- solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.
(b) Partial differential equation of first order of following form- (i) f (p, q) = 0; (ii) f (p, q, z)=0; (iii) f(x, p) = g (y, q); (iv) Pp + Qq =R (Lagrange's Form); (v) Z=px+qy+f(p, q) (Clairaut form) (7)

Text Books:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar. Poona Vidhyarthi Publisher
2. Higher Engineering Mathematics by B.S.Grewal. Khanna Publishers
3. Introduction to method of Numerical Analysis- S. S. Shastry, Second Edition, PHI Pvt. Ltd.,New Delhi.

References:

1. A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008
2. Advancing Engg. Mathematics, E.K.Kreyzig, John Wiley
3. Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI 4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

3ETC02 - Electronic Devices & circuits Max. Marks: 80

Course Requisite:

1. Engineering Physics

Course Objectives:

1. To understand detail analysis of Electronic devices.
2. To understand use of electronic devices for various applications in Electronic circuits.
3. To analyze various electronic circuits.

Course Outcomes:

After successfully completing the course, the students will be able to
1. Comprehend the knowledge of diode and its applications in rectifier and regulator circuits.
2. Understand basics of BJT, JFET, MOSFET, UJT and their operational parameters.
3. Understand feedback concept, topologies and their applications.
4. Implement and analyze various electronic circuits.

	Subject: Electronic Devices & circuits	L
Unit-1	**PN junction diode:** Formation of p-n junction, biasing the diode, current equation and V-I characteristics of diode, static and dynamic resistance, Analysis of Half Wave Rectifier (HWR), Full Wave Rectifier (FWR), introduction to filters C, L,LC and CLC filters, working of diode as a Switch, Zener diode and its application as voltage regulator.	06
Unit-2	**Waveshaping:** Analysis of RC low pass, and high pass filters for Sinusoidal, Step, Pulse, Square signal, analysis of clipping and clamping circuits using diodes.	06
Unit-3	**Bipolar Junction Transistors:** Operation of PNP and NPN transistor, CB, CE and CC configurations with characteristics and parameters, transistor as a switch, Transistor switching times, dc load line, transistor biasing methods, bias stability, Introduction to voltage divider biased CE amplifiers using h-parameter model.	06
Unit-4	**Feedback amplifiers**: Feedback concept, effects of negative feedback, basic feedback topologies **Sinusoidal oscillators**: Barkhausen's criteria, Hartley, Colpitts, RC Phase shift, Wein bridge and crystal oscillators.	06
Unit-5	**Multistage Amplifiers**: Need of multistage, direct coupled amplifier, RC coupled amplifier, transformer coupled amplifier, emitter follower, Darlington emitter follower, bootstrapping principle (analysis not expected).	06
Unit-6	**JFET:** Theory, construction and characteristics: parameters (μ, gm & rd) **MOSFET**: Theory, construction and characteristics of enhancement & depletion type MOSFET. **UJT:** Theory, construction and characteristics; UJT as relaxation oscillator.	06
	Total	**36**

Text Books:
1. David Bell: Electronic Devices and Circuits, Oxford University Press, 2010.
2. Milliman and Halkias: Integrated Electronics, Tata McGraw Hill, New Delhi.

References:
1. Robert L.Boylestad, "Electronic Devices and Circuit theory", Publ. Pearson Education.
2. Floyd, "Electron Devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.

3ETC06 - ELECTRONIC DEVICES AND CIRCUITS - LAB

Course Requisite:
1. Engineering Physics
2. 3ETC02 Electronic Devices and Circuits

Course Objectives:
1. To verify characteristics of various semiconductor devices.
2. To determine and verify various performance parameters of electronic devices and circuits.
3. To provide basic experimental exposure about operation and applications of electronic devices.

Course Outcomes:

1. Acquiring basics of parameters and operation of various semiconductor devices.
2. Implementation of basic circuits using electronic devices.
3. Verification and analysis of performance of electronic circuits.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	To verify V-I characteristics of p-n junction diode and obtain static and dynamic resistance values.
Expt – 2	To calculate efficiency and ripple factor of Half wave, Full wave and Bridge wave rectifier.
Expt - 3	To study different types of filter circuits and calculate its ripple factor for C-filter.
Expt - 4	To study Zener diode as a voltage regulator.
Expt – 5	To observe the response of RC Low pass circuit for a square wave input for different time Constant i) RC >>T ii) RC = T iii) RC <<T.
Expt - 6	To observe the response of RC High pass circuit for a square wave input for different time Constants i) RC>>T ii) RC = T iii) RC<<T.
Expt – 7	To obtain output characteristics of the clipping circuits for different reference voltages and to verify the responses.
Expt – 8	To study and observe the performance of various clamper circuit.
Expt – 9	To verify characteristics of CE mode of BJT and compute its parameters such as gain(β),input and output Impedance.
Expt – 10	To compare calculate and observe frequency response of oscillations of 3 stage RC phase shift oscillator.
Expt - 11	To compare calculate and observe frequency response of oscillations of RC Wein Bridge oscillator.
Expt – 12	To plot frequency response of RC coupled amplifier and determine its bandwidth.
Expt – 13	To plot frequency response of Transformer coupled amplifier and determine its Bandwidth.
Expt – 14	To sketch the drain and transfer characteristics of n-channel JFET and determine ac drain resistance, trans-conductance and amplification factor
Expt – 15	To sketch V-I characteristics of UJT and determine Intrinsic stand-off ratio
Expt – 16	To analyze the response of Rectifier, Amplifier, Oscillator, using simulation software.

* Minimum 08 experiments should be conducted out of above enlisted.

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3ETC03 - DIGITAL SYSTEM DESIGN Max. Marks: 80

Course Requisite:

1. Engineering Physics

Course Objectives:

1. To study basic concepts of Boolean algebra, number systems and codes.
2. To study techniques of minimization of Boolean expression.
3. To study the formal procedures for the analysis and design of combinational circuits.
4. To study the formal procedures for the analysis and design of sequential circuits.
5. To learn digital logic families, Programmable logic Devices.
6. To learn the semiconductor memories and mapping.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Use Boolean algebra to solve logic functions, minimization techniques, number systems and its conversion, arithmetic functions.
2. Identify, analyze and design combinational and sequential circuits.
3. Understand digital logic families and their characteristics.
4. Use the knowledge of semiconductor memories and mapping of memories, programmable logic devices in digital design.

	Subject: DIGITAL SYSTEM DESIGN	L
Unit-1	**Number systems and codes:-** Number system and their conversions, BCD codes, Octal codes, Hexadecimal codes, Excess-3 code, Gray Code, Arithmetic Operations using 1's complement and 2's complement Introduction, Basic Digital Circuits: AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR.	06
Unit-2	**Logic gates, Boolean Algebra and Minimization Techniques:-** Boolean Algebra, Demorgans Theorem, Simplifications using Boolean Algebra , SOP and POS form, K-map representation and minimization of logical functions upto 4 variables, don't care conditions, Quine McCluskey method.	06
Unit-3	**Combinational logic design using 74XX/54XX MSI chip:-** Adders, Subtractors, 4-bit parallel adder, look ahead carry BCD adder, MUX, DEMUX, Decoders, Encoders, Code Converters, Comparators, Parity Generator/Checker, BCD to 7 segment decoder, combinational logic design using ROM, PLA, PAL.	06
Unit-4	**Flip-flops, Registers and Counters:-** S-R, J-K, Master slave J-K, D-type, T-type. Shift Registers: Mode of operations of shift registers, Universal Shift Register. Counters: Asynchronous and Synchronous counter, up/down counter, MOD-N counter, Ring counter, Johnson counter, Frequency Division Counter.	06
Unit-5	**Logic families and Memories:-** TTL NAND gate, specification noise margin, propagation delay, fan-in, fan-out, tri-state TTL, ECL, CMOS. Semiconductor Memories: - RAM, ROM, EPROM, EEPROM, SRAM, DRAM.	06
Unit-6	**Analysis of Clocked Sequential Networks**:- Moore and Mealy Machine, State table, State Assignment, State Reduction, State Transition diagram, Sequence Generator, Sequence Detector.	06
	Total	**36**

Text Books:

1. M.Morris Mano and M.D.Ciletti, "Digital Design", Pearson Education.
2. R P Jain, "Modern Digital Electronics", TMH.

Reference Books:

1. Wakerly, "Digital Design: Principles and Practices", 3rd edition, Pearson Education, 2004.
2. Charles H. Roth, "Fundamentals of Logic Design", 4th Edition, Jaico Publication
3. Lee S.C, "Digital Circuits and Logic Design", PHI
4. Richard S. Sandige, "Modern Digital Design", McGraw-Hill Series in Electrical Engineering.

3ETC07 - DIGITAL SYSTEM DESIGN - Lab

Course Requisite:

1. Engineering Physics lab

Course Objectives:

1. To impart the concepts of digital electronics.
2. To provide students basic experimental experiences in the operation of various digital logic Families.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.
5. To learn Semiconductor memories and mapping.

Course Outcomes:

After successfully completion of the lab course the students will be able to:

1. Apply practically the concepts of digital electronics.
2. Explain the operation and characteristics of various digital logic families.
3. Understand the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits.
6. Design and mapping of various types of memories.

Expt. No.	**Experiment List**
Expt-1	To study and verify the operation of various digital logic families.
Expt -2	To study and verify the operation of logic gates.
Expt -3	Design and implementation of Adders and Subtractors using logic gates.
Expt -4	Design and implementation of code converters using logic gates.
Expt -5	Design and implementation of multiplexer using logic gates and IC.
Expt -6	Design and implementation of demultiplexer using logic gates and IC.
Expt -7	Design and implementation of code converters using logic gates.
Expt -8	Design and implementation of Magnitude Comparator using logic gates and IC.
Expt -9	Design and implementation of odd/even parity checker /generator using IC.
Expt -10	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
Expt -11	Construction and verification of ripple counters.
Expt -12	Design and implementation of 3-bit synchronous up/down counter

* Minimum 08 experiments should be conducted out of above enlisted.

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3ETC04 - ELECTROMAGNETIC WAVES Max. Marks: 80

Course Requisite:

1. Engineering Mathematics-I
2. Engineering Mathematics-II
3. Engineering Mathematics-III

Course Objectives:

The objectives of the course are,

1. To introduce basic mathematical concept of coordinate system and vector integrals.
2. To impart knowledge of the basic concepts of electric fields.
3. To impart knowledge of the basic concepts of magnetic fields.
4. To understand the Maxwell's Equations for Electric & Magnetic Field, Boundary conditions and their interpretation.
5. To introduce concept of propagation of electromagnetic waves in free space, conductors and dielectrics.
6. To understand, analyze and evaluate the radiation of electromagnetic wave from theoretical and practical antennas.

Course Outcomes:

At the end of this course students will demonstrate the ability to :

1. Understand the coordinate systems and vector integrals.
2. Evaluate Electric Field Intensity for different charge distributions.
3. Evaluate Magnetic Field Intensity due to current carrying conductors.
4. Understand scientifically about Maxwell's equations & Boundary conditions.
5. Characterize uniform plane wave & can calculate reflection and transmission coefficient of waves at media interface.
6. Understand principle of radiation and radiation characteristics of theoretical & practical antennas.

	Subject: Electromagnetic Waves	L
Unit-1	**Introduction to Vector analysis:** Coordinate systems, Basics of Vectors: Vector products, Projection of vectors, Gradient, Divergence & Curl, Vector integrals, Divergence Theorem & Stokes Theorem.	06
Unit-2	**Electrostatics:** Introduction to Coulomb's law &Electric Field Intensity, Evaluation of Electric Field Intensity due to point charge, line charge & surface charge distribution. Introduction to Electric Flux, Electric Flux Density, Electrostatic potential, Potential gradient &Electric dipole.	06
Unit-3	**Magnetostatics:** Introduction to Biot Savart's law, Ampere's circuital law, Magnetic Field Intensity (without numericals), Evaluation of Magnetic Field intensity due to infinite, finite & circular current carrying conductors. Introduction to Magnetic Flux, Magnetic Flux Density, Magnetic dipole.	06
Unit-4	**Maxwell Equations & Boundary Conditions:** Derivation of Maxwell's Equations for Electric & Magnetic Field (without numericals). Boundary condition at dielectric-dielectric interface, dielectric-conductor interface &Boundary conditions for magnetic materials interface.	06
Unit-5	**Electromagnetic Wave Propagation:** Uniform plane wave, Propagation of wave, Formulation of wave equation in free space, dielectric &conducting medium, Skin depth, Poynting Theorem, Reflection and refraction of electromagnetic waves with normal incidence at dielectric interface.	06
Unit-6	**Radiation:** Scalar & Vector magnetic potential, Retarded Potential, Radiation of Electromagnetic wave from the Hertzian Dipole ,Quarter wave Monopole and Half-wave Dipole antennas.	06
	Total	**36**

Text Books:

1. William H.Hayt,Jr and John A.Buck., "Engineering Electromagnetics", Tata McGraw-Hill Publishing Ltd.
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

Reference Books :

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997. 4. David Cheng, Electromagnetics, Prentice Hall Course

3ETC05: OBJECT ORIENTED PROGRAMMING Max. Marks: 80

Course Requisite:

4. Computer Programming

Course Objectives:

1. To learn object-oriented concepts and build simple applications using C++ and Java.
2. To understand the basic concepts and techniques which form the object-oriented programming paradigm

Course Outcomes:
After successfully completing the course, the students will be able to:
1. Justify the basic concepts of object-oriented programming such as data types, functions, classes, objects, constructors, inheritance, overloading etc.
2. Design, implement, test, and debug simple programs in C++.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. To know the concept of operator overloading
5. Understand inheritance in C++
6. Design and test the implementation of Java programming concepts

	Subject: OBJECT ORIENTED PROGRAMMING	L
Unit-1	Principles of object-oriented Programming: OOP'S paradigm, basic concept of OOP'S, benefits of OOP'S, Four pillars of OOP, structure of C++ programming, basic data types.	06
Unit-2	User defined data type, derived data type, Abstract data types in C++, operators and control statement, Functionsin C++: Functions, Function over loading, Friend Functions and virtual functions.	06
Unit-3	Classes and objects in C++: Types of classes and its use, concept of object and its implementation, constructor and destructors.	06
Unit-4	Operator and their definition, overloading unary and binary operator, rules for overloading operators, overloading binary operators using friends and string manipulation.	06
Unit-5	Inheritance in C++: Extending classes: Multilevel Inheritance, Multiple inheritances, Hierarchical inheritance, Hybrid inheritance, Virtual base classes and Abstract classes.	06
Unit-6	Introduction to Java programming, JVM, Java programming constructs: variables, primitive data types, identifier, literals, operators, expressions, primitive type conversion and casting, Basics of classes, objects, creating objects, and methods in Java.	06
	Total	**36**

Text Books:
1. E Balagurusamy, "Object Oriented Programming Using C++ and JAVA", Tata McGraw-Hill.
2. E Balagurusamy, "Object Oriented Programming Using C++" ,Tata McGraw-Hill.

Reference Books :
1. Bjarne Stroustrup, "C++ Programming Language", Pearson Education.
2. H.M.Dietel and P.J.Dietel, "Java How to Program" Pearson Education/PHI, Sixth Edition.
3. Robert Lafore, "Object-Oriented Programming in C++ ", Pearson Education India, (4th Edition).
4. Herbert Schildt , "Java : The Complete Reference" Tata McGraw-Hill (7th Edition).
5. Yeshwant Kanetkar "Let us C++", BPB Publications.
6. Dr. N.B. Vekateswarlu, Dr. E.V. Prasad, "Learn Object Oriented Programming Using Java: An UML Based", S. Chand Publication.

3ETC08 : OBJECT ORIENTED PROGRAMMING -LAB.

Course Requisite:
1. Computer Programming
2. 3ETC05 Object Oriented Programming

Course Objectives:
1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Design and test the implementation of C++ programming concepts.
3. Design and test the implementation of java programming concepts.

Course Outcomes:
After successfully completing the course, the students will be able to
1. Justify the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
2. Design, implement, test, and debug simple programs in an object-oriented programming language.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. Design and test the implementation of C++ and java programming concepts.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	Write a C++ program to swap two variables a) Using third variable b) Without using third variable.
Expt – 2	Write a program in C++ to print the area and perimeter of a rectangle.
Expt - 3	Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
Expt - 4	Develop programs to implement the concepts of classes and object, accessing members: e.g. a. Design an EMPLOYEE class to contain Data members: Employee_Number, Employee_Name, Basic_Salary, All_Allowances, IT, Net_Salary. Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.
Expt – 5	Write a program in C++ to implement parameterized constructor and copy constructor.
Expt - 6	Write a C++ program to implement function overloading.
Expt – 7	Write a program in C++ illustrating the use of virtual functions in a class.
Expt – 8	Write a C++ program to overload unary operator for inverting the value of data variable using member function.
Expt – 9	Write a program in C++ to demonstrate multiple inheritances.
Expt – 10	Write a program in C++ to demonstrate multilevel inheritance.
Expt - 11	Write a program in C++ to implement virtual base class.
Expt – 12	Write a java program to Calculate Circle Area.
Expt – 13	Write a program in Java that reads a number in meters, converts it to feet, and displays the result.

* Minimum 08 experiments should be conducted out of above enlisted.

Semester - IV

4ETC02 - ANALOG CIRCUITS Max. Marks: 80

Course Requisite:

1. (3ETC02) Electronic Devices and Circuits

Course Objectives:

1. To understand the basics and internal structure of Op-Amp.
2. To analyze and design linear and non-linear applications of Op-Amp.
3. To understand and design concepts of voltage regulators.
4. To study and synthesize the waveform generators using IC 555 and IC 565.
5. To demonstrate applications of Op-Amp in temperature monitoring.

Course Outcomes:

After successfully completing the course, the students will be able to

1. Perform evaluation of the switching behavior of semiconductor devices.
2. Comprehend the knowledge of basic concepts and performance parameters of Op-Amp.
3. Use Op-Amp for implementation of linear and non-linear applications.
4. Comprehend the knowledge of PLL, its applications and data converters.

	Subject: Analog Circuits	L
Unit-1	**Operational amplifier** Block diagram of Op-Amp, differential amplifier configurations using BJT, constant current source, level shifting, transfer characteristics, frequency response, study of ICuA741, Op-Amp parameters, Inverting and non inverting amplifiers	06
Unit-2	**Linear applications of Op-Amp:** Theory & Design of scaling, summing, differential amplifier, integrator and differentiator, sinusoidal RC oscillators: RC-phase shift, Wein bridge oscillator using IC 741.	06

Unit-3	**Non Linear Applications of Op-Amp:** Theory & Design of Op-amp IC 741 based comparator, zero-crossing detector, window detectors, Schmitt trigger, astable multivibrator as square and triangular wave generator, monostable multivibrator	06
Unit-4	Design of Voltage regulators using IC 723 and LM 317, Design of instrumentation amplifier, bridge amplifier, temperature Controller/indicator using RTD.	06
Unit-5	Introduction to IC 555, IC 555 based design of Astable, Monostable multivibrator and their applications, A to D converters: Successive approximation & Dual Scope, D to A converters : Weighted Register & R-2R Ladder.	06
Unit-6	PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC LM 565 and its applications as AM detector, FM detector, Design of Butterworth first and second order low pass, high pass, all pass filter, design of notch filter.	06
	Total	**36**

Text Books:

1. R.A. Gayakwad, "OP-AMP and Linear Integrated Circuits", Prentice Hall/ Pearson Education Publications.
2. K R Botkar "Integrated Circuits" Khanna Publications.
3. Sergio Franco, "Design with Linear Integrated Circuits & Op-Amps",TMH Publications.

References:

1. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley Intl. Publication.
2. Paul Horowitz, W. Hill, "The art of Electronics", Cambridge Publications.

4ETC07 – ANALOG CIRCUITS LAB

Course Requisite:

1. (3ET3) Electronic Devices and Circuits.
2. (4ETC02) Analog Circuits

Course Objectives:

1. To verify operation of various wave shaping circuits.
2. To demonstrate linear and non-linear applications of Op-Amp.
3. To analyze multivibrator circuits using BJT and Op-Amp.
4. To understand functions and characteristics of PLL.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Implement wave shaping circuits using passive components, diode and BJT and perform their analysis.
2. Demonstrate linear and non-linear applications of Op-Amp.
3. Implement PLL in certain applications.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	To verify Op-Amp IC 741 as an inverting and non- inverting amplifier with a specific gain value.
Expt – 2	To demonstrate integrator and differentiator circuit using Op-Amp IC 741.
Expt - 3	To verify RC- phase shift oscillator using Op-Amp IC 741.
Expt - 4	To verify Op-Amp IC 741 as a Schmitt trigger and calculate the hysteresis voltage.
Expt – 5	To verify operation of astable multivibrator using Op-Amp IC 741.
Expt - 6	To plot frequency response of first order Butterworth LPF for a specific pass-band gain and cut-off frequency.

Expt – 7	To verify characteristics of PLL.
Expt – 8	Application of PLL as AM detector/FM detector/frequency translator (Any one application)
Expt – 9	Design transistorized series voltage regulator
Expt – 10	Design a low voltage variable regulator to 7 V using IC 723.
Expt - 11	Design of summing amplifier using IC 741.
Expt – 12	Design of Schmitt trigger.
Expt – 13	Design of integrator and differentiator.
Expt – 14	Design of sinusoidal RC phase shift oscillator.
Expt – 15	Design and setup a Wien-bridge oscillator.
Expt – 16	Design the square and triangular wave generator using IC 741.
Expt – 17	Design a Butterworth high pass filter with specifications.

* Minimum 08 experiments should be conducted out of above enlisted.

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4ETC03 - NETWORK THEORY Max. Marks: 80

Course Requisite:
1. Electrical Engineering.
2. Engineering Mathematics.

Course Objectives:
1. To understand fundamental concepts of Node and Mesh analysis for linear circuits.
2. To study Network Theorems for circuit analysis.
3. To study Graph Theory for network analysis.
4. To apply Laplace Transform Technique for analysis of linear circuits.
5. To study Two Port Network parameters.
6. To study Network Functions.

Course Outcomes:

After successfully completing the course, the students will be able to:
1. Analyze electrical circuits using Mesh and Node analysis.
2. Apply suitable Network Theorem to analyze electrical circuits.
3. Draw oriented Graph of the network to determine their currents and voltages.
4. To implement the concept of Laplace Transform for electrical circuit analysis.
5. To apply Two-Port network theory for electrical network analysis.
6. To evaluate different Network Functions.

	NETWORK THEORY	L
Unit-1	**Node and Mesh analysis**: Circuit components, assumptions for circuit analysis, Sources of electrical energy, Source transformation, Kirchoff's laws, Node and Mesh analysis, Matrix approach of network containing voltage and current sources and reactances, Network equations for RLC networks.	08
Unit-2	**Network Theorems**: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Compensation theorem, Tellegen's theorem as applied to AC cicuits.	08
Unit-3	**Graph theory and network equations**: Graph of a network, Trees, cotrees and loops, Incidence matrix, Tie set and Cut set of a network, Analysis of a network using Tie set and Cut set matrix, Network equilibrium equations (without magnetic coupling), Duality.	08

Unit-4	**Network Analysis using Laplace Transform**: Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL and RLC networks with and without initial conditions. Initial and Final value theorems.	08
Unit-5	**Two port networks**: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Inverse transmission parameters, Hybrid and Inverse hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interconnection of two port networks.	08
Unit-6	**Network functions**: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function, Application of network analysis in deriving functions, Time domain behaviour from pole-zero plot, driving point and transfer impedance functions of LC networks.	08
	Total	**48**

Text Book: D. Roy Choudhary, "Networks and Systems", New Age International.

Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall,3rd Edition.
2. Sudhakar A., Shyammohan S. P. "Circuits and Network" ; Tata McGraw-Hill New Delhi, 1994
3. W. H. Hayt, J. E. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 7th Edition, Tata McGraw-Hill education private Limited, New Delhi.
4. Abhijit Chakrabarti, "Circuit theory, Analysis and Synthesis",Dhanpat Rai and Co. Pub.

4ETC08 - NETWORK THEORY - LAB

Course Objectives:

1. To apply knowledge of Mesh and Node analysis for a given network.
2. To learn various network theorems and apply them to solve networks.
3. To apply knowledge of Two Port network and Network Functions to analyze given network.

Course Outcomes:

After successfully completion of the lab course the students will be able to:

1. To apply knowledge of Mesh and Node analysis for a given network.
2. To apply various network theorems to solve networks.
3. To apply knowledge of Two Port network and Network Functions to analyze given network.

Expt. No.	Experiment List
Expt-1	To verify Node Analysis for electric circuit.
Expt -2	To verify Mesh Analysis for electric circuit.
Expt -3	To verify Superposition theorem for a given network.
Expt -4	To verify Thevenin's theorem for a given network.
Expt -5	To verify Norton's theorem for a given network.
Expt -6	To verify Reciprocity theorem for a given network.
Expt -7	To verify Maximum Power Transfer theorem for a given network.
Expt -8	To determine and verify open circuit (Z) Impedance parameters of a given Two Port network.
Expt -9	To determine and verify short circuit (Y) Admittance parameters of a given Two Port network.
Expt -10	To determine and verify Transmission (ABCD) parameters of a given Two Port network.
Expt -11	To determine and verify Hybrid (h) parameters of a given Two Port network.
Expt -12	To find the driving point Impedance for a given network.
Expt -13	To find the Voltage Transfer Ratio for a given network.
Expt -14	To study RLC series circuit using any simulation Tool.
Expt -15	To study RLC parallel circuit using any simulation Tool.

- Minimum 08 experiments should be conducted out of above enlisted.

4ETC04 – SIGNALS AND SYSTEMS Max. Marks: 80

Course Requisite: Engineering Mathematics-III

Course Objectives:

1. Understand the fundamental characteristics of signals and systems.
2. Understand signals and systems in terms of both the time and transform domains.
3. Develop the mathematical skills to solve problems involving convolution and sampling.

Course Outcomes:

After successfully completing the course, students will be able to

1. Understand the continuous time signals and systems mathematically and their classification along with the mathematical operations that can be performed on them.
2. Understand the spectral characteristics of continuous-time periodic signals using Fourier series.
3. Analyze the spectral characteristics of continuous-time aperiodic signals and systems using Fourier Transform.
4. Apply the Laplace transform for analysis of continuous-time systems.
5. Understand the Discrete Time signals and systems mathematically and understand their classification along with the mathematical operations that can be performed on them.
6. Analyze the spectral characteristics of Discrete Time signals and systems using Discrete Time Fourier Transform.

	Subject: Signals and Systems.	L
Unit-1	**Continuous time signals and systems**: Signal Classification, Energy and Power Signal, Signal Operations, Signal models, Even and Odd functions, convolution, System Classification	06
Unit-2	**Continuous-Time Signal Analysis -The Fourier Series:** Periodic Signal Representation by Trigonometric Fourier Series, Existence and Convergence of Fourier Series, Gibbs Phenomenon, Exponential Fourier Series, Magnitude and phase plots of Fourier coefficients.	06
Unit-3	**Continuous-Time Signal Analysis-The Fourier Transform:** Aperiodic Signal Representation by Fourier Integral, Properties of Fourier Transform, Signal Transmission Through LTIC Systems, Signal energy, Inverse Fourier Transform, plotting Fourier Spectrum.	06
Unit-4	**Continuous-Time System Analysis Using Laplace Transform**: Laplace Transform, Region of convergence, Inverse Laplace transforms Application of Laplace transform for determination of solution of differential equation and System realization up to second order, Frequency response of LTIC system.	06
Unit-5	**Time-Domain Analysis of Discrete-Time Signals & Systems:** Signal Operations, Classification of Discrete-Time Systems, Discrete-Time System Equations, System response to Internal condition, Unit Impulse Response, System response to External Input, Classical Solution of Linear Difference Equations.**Sampling and Reconstruction:** Sampling theorem, signal reconstruction spectral.	06
Unit-6	**Fourier Analysis of Discrete-Time Signals:** Discrete-Time Fourier Series (DTFS), Aperiodic Signal Representation by Fourier Integral, Properties of DTFT, Relationship between DTFT & CTFT.	06
	Total	**36**

Text Books:

1. Lathi B. P., "Principles of Linear Systems and Signals" Second Edition (International Version) Oxford University Press.
2. Alan V. Oppenheim & Alan S. Willsky with S. Hamid Nawab, "Signals & Systems" PHI Publication, Second Edition.

Reference Books:

1. Ambardar A., "Analog And Digital Signal Processing", Thomson Learning-2005.
2. Simon Haykin, Barry Van Veen, "Signals & Systems", IInd Edition, Wiley Pub.
3. Michael J. Roberts, "Signals and Systems Analysis Using Transform Methods and MATLAB", Mc Hill Publication.

4ETC09 – SIGNALS AND SYSTEMS - LAB

Course Requisite:

4ETC04 Signals & Systems.

Course Objectives:

1. To use software to visualize analysis of Signals and System.
2. To manipulate the time signals and identify the type of given system.

Course Outcomes:

1. After successful completion of this course, students will be able to
2. Generate different plots and explore results to draw valid conclusions and inferences in Signal Processing.
3. Enable on how to approach for requirement of signal processing and system design using simulation tools.
4. Familiarize with the concepts of sampling.

List of Experiments :

Experiment No.	Aim of Experiment
Expt - 1	Study of Signal Processing Functions used in MATLAB/SCILAB.
Expt – 2	Program to generate standard continuous Time Signals.
Expt - 3	Program to generate standard discrete Time Signals.
Expt - 4	Program to perform basic operations on Signals.
Expt – 5	Program to find Even And Odd parts of a signal.
Expt - 6	Program to check Periodicity of signals.
Expt – 7	Program to find the Energy and Power of a Signal.
Expt – 8	Program to identify a given system as linear/ non-linear, time variance/ invariance property of a given system.
Expt – 9	Program to demonstrate the time domain sampling of band limited signals (Nyquist theorem).
Expt – 10	Program to find Fourier transform of given signal.
Expt - 11	Implement system equation using Simulnk/Xcos to find output of system for different input signals.
Expt – 12	Find unit step response of system described by transfer function using Simulink/Xcos.

* Minimum 08 experiments should be conducted out of above enlisted.

4ETC05 – VALUES & ETHICS (HS)

Max. Marks: 80

Course Requisite:

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship, and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

	Subject: Values & Ethics	L
Unit-1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validations the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.	06
Unit-2	**Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity.	06
Unit-3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Incorporating Universal Human Values in Technical Education (An AICTE Initiative), Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.	06
Unit-4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** Understanding the harmony in the Nature, Interconnectedness, and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	06
Unit-5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values, Definitiveness of Ethical Human Conduct , Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems.	06
Unit-6	Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations. (6 Hrs) Note: Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.	06
	Total	**36**

Text Books and Teachers Manual :

1. A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Asthana, G.P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Asthana, G.P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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B.E. COMPUTER SCIENCE & ENGG. SEM. III & IV

Syllabus of B.E. Sem. III (Computer Science & Engineering)

3 KS01/3IT01/3KE01 ENGINEERING MATHEMATICS-III

Course Objectives:-

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Apply Laplace transform to find solution of linear differential equations. And solve problems related to Fourier Transform
- Compute and interpret the correlation coefficient.
- Compute the Analytic function and Complex Analysis.
- Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and linear differential equations .
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Demonstrate the basic concepts of probability and statistics.
5. Apply the knowledge of Complex Analysis.
6. Apply the knowledge of vector calculus to solve physical problems.

SECTION-A

UNIT-I: **Ordinary differential equations**:- Complete solution, Operator D, Rules for finding commplementary function, the inverse operator, Rules for finding the particular integral, Method of variation of parameters, Cauchy's and Legendre's linear differential equations. (7)

UNIT-II: **Laplace Transform:-** Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Initial and final value theorem, Convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function . (7)

UNIT-III: **a) Applications of Laplace Transform:-** Solution of Linear differential equations, Simultaneous differential equation by Laplace transform method

b) Fourier Transform:- Definition, standard forms, Fourier transforms, properties of Fourier transforms, Convolution theorem, Fourier sine and Fourier cosine transforms and integrals, inverse Fourier transforms.(7)

SECTION-B

UNIT-IV: **a) Partial differential equation** of first order of following form:- (i)f (p,q) = 0; (ii) f (p,q,z) = 0; (iii) f (x, p) = g (y,q); (iv) P p + Qq = R (Lagranges Form); (v) z = px + qy + f(p,q) (Clairauts form)

b) Statistics Curve fitting: Least Square Method, Coefficient of Correlations, Lines of Regression. (7)

UNIT-V: **Complex Analysis: -** Functions of complex variables, Analytic function, Cauchy- conditions, Harmonic function, Harmonic conjugate functions, Milne's Method, conformal mappings (translation, rotation, magnification and bilinear transformation), Expansion of function in Taylor's and Laurent's series. (7)

UNIT–VI: **Vector calculus**:- Scalar and vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion Formulae (without proof), line, surface, volume integrals, irrotational Solenoidal Vector fields. (7)

TEXT BOOKS:

1. Elements of Applied Mathematics Vol. II by P. N. Wartikar and J.N. Wartikar,
2. Higher Engg. Mathematics by B.S. Grewal.

REFERENCE BOOKS:

1. Advancing Engg. Mathematics by E.K.Kreyzig.
2. A text book of Differential Calculus by Gorakh Prasad.
3. A Text Book of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.
4. Engineering Mathematics by Ravish R Singh, Mukul Bhatt.

3KS02 DISCRETE STRUCTURE AND GRAPH THEORY

Course Pre-requisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure and Graph Theory by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Apply logical reasoning to solve a variety of problems.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Develop the given problem as graph net works and solve with techniques of graph theory

Unit I: Foundations: Logic and Proofs (Hours: 7)
Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments, Resolution, Combination for Propositions and Quantified Statements; Proofs Terminology, Methods, Direct Proofs, Proof by Contraposition and Contradiction;

Unit II: Sets, Functions and Relations (Hours: 7)
Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations; Inverse Functions, Compositions and Graphs of Functions, Important Functions, Partial Functions; Sequences, Recurrence Relations, Special Integer Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; n-ary Relations, Operations on n- ary Relations; Representing Relations Using Matrices; Closures, Transitive Closures

Unit III: Number Theory and Induction (Hours: 6)
Division, The Division Algorithm, Modular Arithmetic, Arithmetic Modulo m; Primes, Trial Division, Conjectures and Open Problems About Primes, GCD and LCM, The Euclidean Algorithm, gcds as Linear Combinations; Linear Congruences, The Chinese Remainder Theorem, Fermat's Little Theorem, Pseudoprimes, Primitive Roots and Discrete Logarithms, Applications: Hashing Functions, Mathematical Induction and Examples of Proofs, Mistaken Proofs, Guidelines for Proofs; Strong Induction, Examples of Proofs.

Unit IV: Algebraic Structures (Hours: 7)
Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations.

Unit V: Counting (Hours: 7)
Basic Counting Principles, Complex Counting Problems, Subtraction and Division Rule, The Pigeonhole Principle, The Generalized Pigeonhole Principle, Applications; Permutations, Combinations, Generating Permutations, Generating Combinations.

Unit VI: Graphs (Hours: 6)
Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings.

Text Book: Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7thEdition, McGraw-Hill.

Reference Books:

1. J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.
2. Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
4. C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

3KS03 OBJECT ORIENTED PROGRAMMING

Course Pre-requisite: Computer Programming

Course Objectives:

1. To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
2. To use the object-oriented paradigm in program design.
3. To Provide programming insight using OOP constructs.
4. To lay a foundation for advanced programming

Course Outcomes : On completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behaviour of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming (Hours:7)
Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, ,Flow of Control.

Unit II: Classes and Objects (Hours:7)
Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

Unit III:Inheritance, Interfaces and Packages (Hours:6)
Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package, Enum type.

Unit IV: Exception handling and Input /Output (Hours:7)
Exception: Introduction, Exception handling Techniques, User-defined exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V: Applets (Hours:7)
Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, get Document Base() and get Code Base () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.

Unit VI: Unit Title: Event Handling (Hours:6)

Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.

Text Books:

1. Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, “Java How to Program” Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer’s Guide to Java Certification, 3rdEdition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners, (SPD), 2010.

3KS04/3KE04 DATA STRUCTURES

Course Pre-requisite: Fundamentals of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes: On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

Unit I: Introduction to Data Structures (Hours: 7)

Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms.String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.

Unit II: Array & Record Structure (Hours: 7)

Linear arrays : Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays.Record structures and Matrices.

Unit III: Linked lists (Hours: 6)

Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection.Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists.

Unit IV: Stack & Queue (Hours: 7)

Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi.

Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues.

Unit V: Trees (Hours: 7)

Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heap sort, Path length & Huffman's algorithm.

Unit VI: Graphs & Sorting Algorithms (Hours: 6)

Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search.

Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort.

Text Books:

1. Seymour Lipschutz: Data Structures, Schaum's Outline Series, McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

3KS05 ANALOG& DIGITAL ELECTRONICS

Course Prerequisite: Basic Physics.

Course Objectives:

1. To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, Field Effect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basics knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits

Course Outcomes : At the end of course students will able to

1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization technique to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: PN Junction Diode and Bipolar Junction Transistor (Hours: 7)

PN-Junction Diode, Characteristics and Parameters, BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, Common- Collector Characteristics

Unit II: Field Effect Transistors (Hours: 7)
Junction Field Effect Transistors, n-Channel and p-Channel JFET, JFET Characteristics, JFET Parameters, FET Amplifications and Switching, MOSFETs: Enhancement MOSFET, Depletion_Enhancement MOSFET, Comparison of p-channel and n-channel FETs, Introduction to CMOS.

Unit III: Number System (Hours: 6)
Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, r's and (r-1)'s Complements Representation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code and Alpha numeric codes.

Unit IV: Minimization Techniques (Hours: 7)
Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey Minimization Technique (up to 5 variable).

Unit V: Combinational Circuits (Hours: 7)
Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits (Hours: 6)
Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Books:

1. David A. Bell: "Electronic Devices and Circuits", 5e , Oxford University Press.
2. Jain R.P. "Modern Digital Electronics", 3e, TMH.

Reference Books:

1. Millman & Halkies: "Electronic Devices & Circuits", 2e, McGraw Hill.
2. Sedra& Smith: "Microelectronics Circuits", 5e, Oxford University Press.
3. Anand Kumar: "Switching Theory and Logic Design", 3e, PHI Learning Private Limited
4. Wakerly, "Digital Design: Principles and Practices", 3 e, Pearson Education, 2004.

3KS06 OBJECT ORIENTED PROGRAMMING - LAB

Course Pre-requisite: Basic Computer Programming

Course Objectives: Design, implement, test, and debug simple programs in an object-oriented programming language.

1. To develop the knowledge of object-oriented paradigm in the Java programming language.
2. To evaluate classical problems using java programming.
3. To develop software development skills using java programming for real world applications.

Course Outcomes : On completion of the course, the students will be able to

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Interpret the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
3. Build applications in Java by applying concepts like interfaces, packages and exception handling.
4. Make use of Java concepts like API, Applets, AWT.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message "Hello World..."
2. Develop a program to explain use of Operators in java.
3. Develop a Program to study and implement Looping Statements belonging to Java**.**
4. Develop a Program to study and implement Selection Statements belonging to Java**.**
5. Develop a program to study and implement some Pyramid.
6. Develop a program to demonstrate the concept of Class, Method and Object.
7. Develop a program to study and implement the concept of Method Overloading.
8. Develop a program to study and implement concept of Constructor in Java.
9. Develop a program to study and implement concept of Constructor Overloading in Java.
10. Develop a program to study and implement the Array in Java.

11. Develop a Program on various ways to accept data through keyboard(Command Line Argument)
12. Develop a program to study and implement the concept of Inheritance.
13. Develop a program to study and implement the concept of Method Overriding.
14. Develop a program to study and implement the Abstract Class.
15. Develop a program to study and implement the concept of Interface in Java.
16. Develop a program to study and implement Exception Handling Mechanism in Java.
17. Develop a program to study and implement Java I/O.
18. Develop a program to study and implement simple Applet in java.
19. Develop a program on Applet to demonstrate Graphics, Font and Color class.
20. Develop a Program on passing parameters to applets
21. Develop a Program to create GUI application without event handling using AWT controls
22. Develop a Program to create GUI application with event handling using AWT controls
23. Develop a program on Multithreading
24. Develop a Program to create GUI application with event handling using Swing controls
25. Mini Project based on content of the syllabus. (Group of 2-3 students)

3KS07 DATA STRUCTURE - LAB

Course Pre-requisite: Basics of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes : On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structure.
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to find out largest number from the array and also find it's location.
2. Write a program to traverse an array and find the sum and average of data elements from an array.
3. Write a Program to a) insert an element in an array b)delete an element from an array.
4. To study and execute the Linear search method
5. To study and execute the Binary Search method
6. To study and execute the Pattern matching Algorithms(Slow and Fast)
7. To study and execute Bubble sort method.
8. To study and implement various operations on singly linked list
   (a) Traversing the linked list.
   (b) Insert a node at the front of the linked list.
   (c) Delete a last node of the linked list.
   (d) Searching a Linked list.
9. To study and implement following operations on the doubly linked list.
   (a) Insert a node at the front of the linked list.
   (b) Insert a node at the end of the linked list.
   (c) Delete a last node of the linked list.
   (d) Delete a node before specified position.
10. To study and implement following operations on the circular linked list.
    (a) Insert a node at the end of the linked list.
    (b) Insert a node before specified position.
    (c) Delete a first node of the linked list.
    (d) Delete a node after specified position.
11. Understand the stack structure and execute the push, pop operation on it.
12. Understand the Queue structure and execute the insertion, deletion operation on it.
13. Formulate and demonstrate Transforming Infix Expressions to Postfix Expression using Stack.
14. Formulate and demonstrate the Evaluation of Postfix Expression using Stack.
15. To study and execute Quick sort method.
16. Understand the Tree structure and implement the Pre-order, In-order, post-order traversingoperations on it.
17. Understand the concept of Recursion and write a program to calculate factorial of a numberusing Recursion.
18. Understand the Heap sort and implement it on given data.
19. Understand the Insertion sort and implement it on given data.

20. Understand the Selection sort and implement it on given data.
21. To study and execute Merge sort method.
22. To study and execute Radix sort method.
23. Write a Program to implement the concept of BFS algorithm.
24. Write a Program to implement the concept of DFS algorithm.
25. To study and execute Josephus problem.

3KS08 ANALOG & DIGITAL ELECTRONICS - LAB

Course Pre-requisite: Students should have the knowledge of Basic Physics.

Course Objectives:
1. To impart the concepts of analog and digital electronics practically.
2. To provide students basic experimental experiences in the operation of semiconductor device and Digital ICs.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.

Course Outcomes : After successfully completing the lab, the students will be able to
1. Apply practically the concepts of analog and digital electronics.
2. Explain the operation and characteristics of semiconductor devices.
3. Illustrate the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits

List of Experiments:

This is a sample list of Experiments; **minimum 10 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study V-I characteristics of a PN Junction diode in Forward and Reverse bias.
2. To Sketch and Study the input and output characteristics of transistor connected in Common Emitter (CE) configuration..
3. To Sketch and Study the input and output characteristics of transistor connected in Common Base (CB) configuration
4. To Sketch and Study the input and output characteristics of transistor connected in Common Collector (CC) configuration.
5. To plot static characteristics of FET & calculate its parameters g_m, r_d and μ.
6. To implement Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7410, 7411, 7420, 7427, 7432, 7486).
7. Study and verify the truth table of half adder and full adder using logic gates.
8. Study and verify the truth table of half subtractor and full subtractor using logic gates
9. To compare two 4 bits number and verify the output using 4-bit comparator IC 7485.
10. Implementation of 4×1 multiplexer using logic gates.
11. Implementation and verification of Demultiplexer and Encoder using logic gates.
12. Implementation of 4bit parallel adder using 7483 IC.
13. Design and verify the 4 bit synchronous counter.
14. Design and verify the 4 bit asynchronous counter.
15. Verification of truth table of SR, JK, T and D Flip Flops.

List of Experiments beyond syllabus:
1. Design and Implementation of Op-amp as an inverting amplifier.
2. Design and Implementation of Op-amp as a non-inverting amplifier.
3. To design and find frequency of A stable multi-vibrator using IC 555.

3KS09 C SKILL - LAB - I

Course Prerequisite: Basic knowledge of any Programming Language

Course Objectives:

1. To be able to program design with functions using Python.
2. To understand data and information processing techniques.
3. To understand to Design a program to solve the problems.
4. To be able to access database using python programming.
5. To be able to design web applications using python programming.

Course Outcomes : On completion of the course, the students will be able to
1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2. Interpret different Decision Making statements, Functions, Object oriented programming in Python
3. Summarize different File handling operations
4. Explain how to design GUI Applications in Python and evaluate different database operations
5. Develop applications using Django framework or Flask

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write python program to store data in list and then try to print them.
2. Write python program to print list of numbers using range and for loop
3. Write python program to store strings in list and then print them.
4. Write python program in which an function is defined and calling that function prints Hello World.
5. Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”
6. Write a program to create, append, and remove lists in python.
7. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
8. Write a program to demonstrate working with tuples in python.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find largest of three numbers.
11. Write python program in which an function(with single string parameter) is defined and calling that function prints the string parameters given to function.
12. Write python program in which an class is define, then create object of that class and call simple print function define in class.
13. Write a Python script that prints prime numbers less than 20.
14. Write a python program to find factorial of a number using Recursion.
15. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.
21. Accessing and working with databases using Python.
22. Create data frame from .csv files and operations on it.
23. Plotting various graphs using Python.
24. Developing basic GUI using Python.
25. Developing web applications using Django framework or Flask

Reference Books :

1. “Core Python Programming”, R. NageswaraRao, dreamtech press.
2. “Python Programming A Modular Approach With Graphics, Database, Mobile and WebApplications”, SheetalTaneja, Naveen Kumar, Pearson.
3. Python Web Development with Django By Jeff Forcier, Paul Bissex, Wesley J Chun, Addison-Wesley Professional.
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning
5. Allen B. Downey , “ Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O’Reilly Publishers
6. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India
7. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley
8. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

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SEMESTER - IV

4KS01 ARTIFICIAL INTELLIGENCE

Course Pre-requisite: Basic concepts of Data Structures, Algorithms, Programming

Course Objectives:

1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem).

Course Outcomes : On completion of the course, the students will be able to

1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem & efficiently solve them.
3. Summarize the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.

4. Apply AI techniques in applications which involve perception, reasoning and learning.
5. Compare the importance of knowledge, types of knowledge, issues related to knowledge acquisition and representation.

Unit I: Introduction to AI (Hours: 7)
Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI,
Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Problem Solving Through AI (Hours: 7)
Introduction, Representation the AI Problems, Production System, Algorithm of Problem Solving, Examples of AI Problems, Nature of AI Problems

Unit III: Uninformed Search Strategies (Hours: 6)
Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit IV: Informed Search Strategies (Hours: 7)
Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis

Unit V: Adversarial Search & Games (Hours: 7)
Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Unit VI: Introduction to Knowledge (Hours: 6)
Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering

Text Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)

Reference Books:

1. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by RajendraAkerkar (PHI Learning Pvt. Ltd.)

4KS02 DATA COMMUNICATION AND NETWORKING

Course Prerequisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To evaluate the errors using various error detection & correction techniques.
6. To understand network based protocols in data communication and networking.

Course Outcomes : On completion of the course, the students will be able to

1. Describe data communication Components, Networks, Protocols and various topology based network architecture
2. Design and Test different encoding and modulating techniques to change digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion,
3. Explain the various multiplexing methods and evaluate the different error detection & correction techniques.
4. Illustrate and realize the data link control and data link protocols.
5. Describe and demonstrate the various Local area networks and the IEEE standards.

Unit I: Introduction to Data Communication (Hours: 7)
Introduction: Data Communication, Components, Networks, Network types: Local Area Network,Wide Area Network, Switching, The Internet, Accessing the Internet, Standards and Administration: Internet Standards, Internet Administration, Network Models:TCP/IP Protocol Suite,TheOSI Model, Transmission media: Introduction, Guided media & Unguided media-Wireless. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit II: Data link Layer (Hours: 6)
Data Link Layer: Introduction, Nodes & Links, Services , Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC): Random Access, Controlled Access, Channelization.

Unit III: Network Layer (Hours: 7)
Introduction to Network layer Network Layer Services: Packetizing, Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service , Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as Packet Switches

Unit IV: Network Layer Protocol (Hours: 7)
Network Layer Protocols: Internet Protocol (IP),Datagram Format, Fragmentation, Security of IPv4 Datagrams,ICMPV4: Messages, Debugging Tools, ICMP Checksum,Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP,Routing algorithms: Distance Vector routing, Link State Routing, IPV6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration, Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses

Unit V: Transport Layer (Hours: 6)
Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggy backing, User Datagram Protocols: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features , Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options, SCTP: SCTP Services, SCTP Features

Unit VI: Application layer (Hours: 7)
Introduction to Application layer: Providing Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication, World wide web and HTTP: World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: Two Connections, Control Connection, Data Connection, Security for FTP, Electronic Mail: Architecture, Web-Based Mail, E-Mail Security, Domain Name System (DNS):Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security of DNS, Network Management: Introduction. Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management, SNMP: Managers and Agents, Management Components, ASN.1: Language Basics, Data Types, Encoding.

Text Book: Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH).

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber : Data Communication, McGraw Hill
3. J.Freey : Computer Communication & Networks, AEW Press
4. D. Corner: Computer Networks & Internet, Pearson Education.

4KS03 OPERATING SYSTEM

Course Pre-requisite: Discrete Structures, Data Structure, Any programming Language

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

Unit I: Introduction to OS (Hours: 7)
Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads

Unit II: Process Scheduling (Hours: 7)
Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling

Unit III: Process Synchronization (Hours: 6)
Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock

Unit IV: Memory Management (Hours: 7)
Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing

Unit V: Unit Title: File System (Hours: 7)
File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery

Unit VI: Unit Title: I/O System (Hours:6)
I/O Systems : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations , Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

Text Book : Avi Silberschatz, P.B.Galvin, G.Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.

Reference Books:

1. A.S.Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D. M. Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P. Balkrishna Prasad: “Operating Systems” Scitech Publications (I) Pvt. Ltd.

4KS04 MICROPROCESSOR & ASSEMBLY LANGUAGE PROGRAMMING

Course Pre-requisite: Computer Programming and Computer Fundamentals

Course Objectives:
1. To explore 8086 microprocessor and its architecture.
2. To introduce interfacing techniques of 8086 microprocessor.
3. To introduce basics of Internet of Things

Course Outcomes : On completion of the course, the students will be able to
1. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
2. Design and Test assembly language programs using 8086 microprocessor instruction set.
3. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language.
4. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.
5. Explain the basic concepts of Internet of Things

Unit I: 8086 Architecture (Hours: 7)
8086 architecture and pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction Set (Hours: 7)
8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 Instruction Set (Hours: 6)
8086 programming: logical instructions. Shift and rotate instructions and their use in 8086 programming. 8086 flag register and Flag control instructions, compare instruction, control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Subroutines& Macros **(Hours: 7)**
The 8086 stack segment and stack related instructions. 8086 I/O Address space.Subroutines and related instructions, Parameter passing, Concept of Macros, Status saving on stack.Concept of recursion at assembly program level.8086 Programming using subroutines, recursion and macros.

Unit V: 8086 Interrupt **(Hours: 7)**
8086 Interrupts types, priority and instructions. Interrupt vector table, External hardware-interrupt interface signals & interrupts sequence. Software interrupts. Non-maskable interrupts. 8086 microprocessor interrupt programming.

Unit VI: Internet of Things (IoT) **(Hours: 6)**
Internet of things: An overview, IoT conceptual framework, IoT Architectural View, Technology behind IoT, Sources of IoT, M2M communication, Examples of IoT.

Text Book:
1. A. K. Ray & K. M. Bhurchandi: Advanced Microprocessors & Peripherals, Third Edition (TMH).
2. Raj Kamal: Internet of Things, Architecture and Design Principals, McGraw Hill Education (India) Private Limited

Reference Books:
1. W. A. Triebel& Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)
2. Liu & Gibson: The 8088/8086 Microprocessor Architecture Programming and Interface (6/e) (PHI)

4KS05 THEORY OF COMPUTATION

Course Pre-requisite: Discrete Mathematics, Data Structures

Course Objectives:
1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability

Course Outcomes: On completion of the course, the students will be able to
1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines **(Hours: 8)**
Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar **(Hours: 8)**
Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages **(Hours: 8)**
Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata **(Hours: 8)**
Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines **(Hours: 8)**
Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability **(Hours: 8)**
Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory

Text Books:

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata

Reference Books:

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. VivekKulkarni : Theory of Computation, OUP India, 2013.

4KS06 DATA COMMUNICATION & NETWORKING LAB

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the working principle of various communication protocols
2. To understand and analyze the signal flow in a digital communication system.
3. To analyze error performance of a digital communication system in presence of noise and other interferences.
4. To evaluate the errors using various error detection & correction techniques.
5. To understand network based protocols in data communication and networking.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze performance of various communication protocols
2. Implement Configure various network protocols.
3. Compare IP Address classes of networks

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study various LAN topologies and their creation using network devices, cables and computers. .
2. To connect the computers in Local Area Network.
3. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
4. Write a program of bit stuffing used by Data Link Layer
5. Write a program to implement CRC(Cyclic Redundancy Check)
6. Write a program to implement Checksum
7. Write a program to implement Sliding window
8. Configure Internet connection and use IP-Config, PING / Tracer and Net stat utilities to debug the network issues.
9. Configuration of TCP/IP Protocols in Windows and Linux.
10. Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.
11. Write a C Program to determine if the IP Address is in Class A, B, C, D, or E
12. Write a C Program to translate Dotted Decimal IP Address into 32 Bit Address.
13. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN(TCP/IP Configuration)

4KS07 OPERATING SYSTEM - LAB

Course Pre-requisite: Basic computer programming

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study Linux Operating System along with its installation.
2. To Study and Execute basic file commands and process related open source Ubuntu commands
    a. Commands to view all executing, block and suspended process.
    b. Command to check and change the priority of process CPU utilization for executing processes.
    c. Commands to check for child process, sub-processes, process tree, abort & end process and all other basics commands related to processes
3. Write a program for multithreading using C.
4. To simulate First Come First Serve & Shortest Job First process scheduling algorithm
5. To simulate Shortest Job First process scheduling algorithm
6. To simulate Preemptive Shortest Job First process scheduling algorithm
7. To implement Round Robin Process scheduling Algorithm
8. To implement Priority Based Process scheduling Algorithm
9. To implement and analyze multi-level queue scheduling algorithm
10. To implement the following file allocation strategies.
11. To simulate paging technique of memory management.
12. To implement theFIFO page replacement policy
13. To implement the LRU page replacement policy
14. To implement the optimalpage replacement policy
15. To simulate producer-consumer problem using semaphores.
16. To implement Dining-Philosophers problem to deal with concurrency control mechanism.
17. To implement contiguous memory allocation strategies to detect fragmentation using: First Fit, Best Fit and Worst Fit.
18. To implement FCFS Disk Scheduling algorithm
19. To implement SCAN Disk Scheduling algorithm
20. To implement C-SCAN Disk Scheduling algorithm
21. To simulate Bankers algorithm for deadlock avoidance
22. To implement following memory management techniques
    Implement MVT and MFT where memory block size is 100 for 5 processes. Enter no. of blocks for each process and calculate internal fragmentation.
23. To simulate LFU page replacement algorithms
24. To simulate the Single level directory file organization techniques.
25. To Simulate bankers algorithm for Dead Lock Avoidance (Banker‘s Algorithm)

4KS08 MICROPROCESSOR & ASSEMBLY LANG. PROG. - LAB

Course Pre-requisite: Computer Programming, Number System

Course Objectives: In this lab student will learn about’ Microprocessor and Interfacing’ in regards to digital computer, microprocessor architecture, programming with 8086 microprocessor and different peripherals**.**

Course Outcomes On completion of the course, the students will be able to

1. Analyze the internal workings of the microprocessor
2. Design and develop programs in Assembly Language Programming
3. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
4. Design and Test assembly language programs using 8086 microprocessor instruction set.
5. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language
6. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Installation and Introduction of TASM Assembler.
2. Write a program for addition of two 8-bits numbers and two 16-bits numbers.
3. Write a program for subtraction of two 8-bits numbers and two 16-bits numbers.
4. Write a program for multiplication of two 8-bits numbers.
5. Write a program for division of two 8-bits numbers
6. Write a program to check whether a given number is even or odd.
7. Write a program to demonstrate Logical Group and Shift Rotate Instructions.
8. Write a program to check whether a given number is positive or negative.
9. Write a program to find greatest of two 8-bits signed &unsigned numbers.
10. Block Transfer Program
11. Write a program to find Factorial of a number using loop instruction.

12. Write a program to find cube of a given number using Subroutine.
13. Write a program to find square of a given number using Subroutine.
14. Write a program to find square of a given number using Macro.
15. Write a program to find whether the string is palindrome or not.
16. To convert BCD Number Program
17. Write a program to perform Reverse of the String
18. Write a program to transfer 10-bytes from one memory bank to another memory bank.
19. Program for sorting an array for 8086 microprocessor.
20. To write an assembly language program to arrange the given numbers in descending order.
21. Program for searching for a number/character in a string for 8086 microprocessor.

4KS09 C-SKILL-LAB II

Course Pre-requisite: Basic knowledge of scripting language, Programming language.Basic understanding of Electronic concepts.

Course Objectives: To develop an ability to design and implement static and dynamic website and to develop embedded systems with the help of Raspberry Pi/Ardino.

Course Outcomes : On completion of the course, a student will be able to

1. Develop client server program and web applications
2. Make use of project-based experience for web application development.
3. Create embedded systems using Raspberry Pi/Ardino

List of Experiments:

This is a sample list of experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to PHP and configure it to work with Apache Web Server.
2. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
3. Create your class timetable using table tag.
4. Create user Student feedback form (use textbox, text area , checkbox, radio button, select box etc.)
5. Create your resume using HTML tags also experiment with colors, text , link , size and also other tags you studied.
6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Develop a JavaScript to display today's date.
8. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
10. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
11. Write a PHP program to display a digital clock which displays the current time of the server.
12. Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix.
13. Write a PHP program to sort the student records which are stored in the database using selection sort.
14. Study and Install IDE of Arduino and different types of Arduino.
15. Write program using Arduino IDE for Blink LED.
16. Write Program for RGB LED using Arduino.
17. Study the Temperature sensor and write a Program for monitor temperature using Arduino.
18. Study and Implement RFID, NFC using Arduino. • Study and implement MQTT protocol using Arduino.
19. Study and Configure Raspberry Pi.
20. WAP for LED blink using Raspberry Pi.
21. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
22. Create Smart Plugs with Arduino and Raspberry Pi.
23. Interfacing digital sensors with raspberry pi.
24. Creating a webpage to control I-O devices, Reading data from sensor and passing to web page.
25. Implement a program to access Analog sensor via wifi with HTML Web server.

SYLLABUS OF B.E. SEM. III & IV [COMPUTER ENGINEERING] (C.B.C.S.)
Semester-III

3KE02 DISCRETE MATHEMATICS

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure and Graph Theory by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Apply logical reasoning to solve a variety of problems.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Develop the given problem as graph net works and solve with techniques of graph theory

Unit I: Foundations: Logic and Proofs
Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments, Resolution, Combination for Propositions and Quantified Statements; Proofs Terminology, Methods, Direct Proofs, Proof by Contraposition and Contradiction. **(Hours 7)**

Unit II: Sets, Functions and Relations
Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations; Inverse Functions, Compositions and Graphs of Functions, Important Functions, Partial Functions; Sequences, Recurrence Relations, Special Integer Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; n-ary Relations, Operations on n- ary Relations; Representing Relations Using Matrices; Closures, Transitive Closures. **(Hours 7)**

Unit III: Number Theory and Induction
Division, The Division Algorithm, Modular Arithmetic, Arithmetic Modulo m; Primes, Trial Division, Conjectures and Open Problems About Primes, GCD and LCM, The Euclidean Algorithm, gcds as Linear Combinations; Linear Congruences, The Chinese Remainder Theorem, Fermat's Little Theorem, Pseudoprimes, Primitive Roots and Discrete Logarithms, Applications: Hashing Functions, Mathematical Induction and Examples of Proofs, Mistaken Proofs, Guidelines for Proofs; Strong Induction, Examples of Proofs. **(Hours 6)**

Unit IV: Algebraic Structures
Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations. **(Hours 7)**

Unit V: Counting
Basic Counting Principles, Complex Counting Problems, Subtraction and Division Rule, The Pigeonhole Principle, The Generalized Pigeonhole Principle, Applications; Permutations, Combinations, Generating Permutations, Generating Combinations. **(Hours 6)**

Unit VI: Graphs
Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings.

Text Book: Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.

Reference Books:

1. J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.
2. Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
4. C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

3KE03 PROGRAMMING METHODOLOGY

Course Prerequisite: Computer Programming

Course Objectives:

1. To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
2. To use the object-oriented paradigm in program design.
3. To Provide programming insight using OOP constructs.
4. To lay a foundation for advanced programming

Course Outcomes: On completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behaviour of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming:
Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, ,Flow of Control. **(Hours: 7)**

Unit II: Classes and Objects:

Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments. **(Hours: 6)**

Unit III: Inheritance, Interfaces and Packages
Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package, Enum type. **(Hours: 7)**

Unit IV: Exception handling and Input / Output
Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package. **(Hours: 7)**

Unit V: Applets

Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics. **(Hours: 7)**

Unit VI: Event Handling
Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar. **(Hours: 6)**

Text Books:

1. SachinMalhotra and SaurabhChoudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, “Java How to Program” Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer’s Guide to Java Certification, 3rd Edition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners,(SPD),2010.

3KE04 / 3KS04 DATA STRUCTURES

Course Prerequisite: Fundamentals of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes: On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain.

Unit I: Introduction to Data Structures
Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms.String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms. **(Hours: 7)**

Unit II: Array & Record Structure
Linear arrays : Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays.Record structures and Matrices. **(Hours: 7)**

Unit III: Linked lists
Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection.Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists. **(Hours: 6)**

Unit IV: Stack & Queue)
Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi.
Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues. **(Hours: 7)**

Unit V: Trees
Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heapsort, Path length & Huffman's algorithm.
(Hours:7)

Unit VI: Graphs & Sorting Algorithms
Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search
Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort. **(Hours: 6)**

Text Books:

1. SeymourLipschutz: Data Structures ,Schaum's Outline Series,McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:

1. Ellis Horowitz, SartajSahni: Fundamentals of Data Structures, CBSPublications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

3KE05 ANALOG ELECTRONICS & DIGITAL LOGIC DESIGN

Course Pre-requisite: Basic Physics.

Course Objectives:

1. To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, Field Effect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basics knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits.

Course Outcomes: At the end of course students will able to

1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization technique to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: PN Junction Diode and Bipolar Junction Transistor (Hours: 7)
PN-Junction Diode, Characteristics and Parameters, BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, Common- Collector Characteristics

Unit II: Field Effect Transistors (Hours: 7)
Junction Field Effect Transistors, n-Channel and p-Channel JFET, JFET Characteristics, JFET Parameters, FET Amplifications and Switching, MOSFETs: Enhancement MOSFET, Depletion_Enhancement MOSFET, Comparison of p-channel and n-channel FETs, Introduction to CMOS.

Unit III: Number System (Hours: 6)
Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, r's and (r-1)'s Complements Representation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code and Alpha numeric codes.

Unit IV: Minimization Techniques (Hours: 7)
Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey Minimization Technique (up to 5 variable).

Unit V: Combinational Circuits (Hours: 7)
Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits (Hours: 6)
Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Books:

1. David A. Bell: "Electronic Devices and Circuits", 5e , Oxford University Press.
2. Jain R.P. "Modern Digital Electronics", 3e, TMH.

Reference Books:

1. Millman & Halkies: "Electronic Devices & Circuits", 2e, McGraw Hill.
2. Sedra & Smith: "Microelectronics Circuits", 5e, Oxford University Press.
3. Anand Kumar: "Switching Theory and Logic Design", 3e, PHI Learning Private Limited
4. Wakerly, "Digital Design: Principles and Practices", 3 e, Pearson Education, 2004.

3KE06 PROGRAMMING METHODOLOGY - LAB

Course Prerequisite: Basic Computer Programming

Course Objectives: Design, implement, test, and debug simple programs in an object-oriented programming language.

1. To develop the knowledge of object-oriented paradigm in the Java programming language.
2. To evaluate classical problems using java programming.
3. To develop software development skills using java programming for real world applications.

Course Outcomes : On completion of the course, the students will be able to

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Interpret the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
3. Build applications in Java by applying concepts like interfaces, packages and exception handling.
4. Make use of Java concepts like API, Applets, AWT.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message “Hello World...”
2. Develop a program to explain use of Operators in java.
3. Develop a Program to study and implement Looping Statements belonging to Java**.**
4. Develop a Program to study and implement Selection Statements belonging to Java**.**
5. Develop a program to study and implement some Pyramid.
6. Develop a program to demonstrate the concept of Class, Method and Object.
7. Develop a program to study and implement the concept of Method Overloading.
8. Develop a program to study and implement concept of Constructor in Java.
9. Develop a program to study and implement concept of Constructor Overloading in Java.
10. Develop a program to study and implement the Array in Java.
11. Develop a Program on various ways to accept data through keyboard(Command Line Argument)
12. Develop a program to study and implement the concept of Inheritance.
13. Develop a program to study and implement the concept of Method Overriding.
14. Develop a program to study and implement the Abstract Class.
15. Develop a program to study and implement the concept of Interface in Java.
16. Develop a program to study and implement Exception Handling Mechanism in Java.
17. Develop a program to study and implement Java I/O.
18. Develop a program to study and implement simple Applet in java.
19. Develop a program on Applet to demonstrate Graphics, Font and Color class.
20. Develop a Program on passing parameters to applets
21. Develop a Program to create GUI application without event handling using AWT controls
22. Develop a Program to create GUI application with event handling using AWT controls
23. Develop a program on Multithreading
24. Develop a Program to create GUI application with event handling using Swing controls
25. Mini Project based on content of the syllabus. (Group of 2-3 students)

3KE07 DATA STRUCTURE - LAB

Course Prerequisite: Basics of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes : On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structure.
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to find out largest number from the array and also find it’s location.
2. Write a program to traverse an array and find the sum and average of data elements from an array.
3. Write a Program to a) insert an element in an array b)delete an element from an array.
4. To study and execute the Linear search method
5. To study and execute the Binary Search method
6. To study and execute the Pattern matching Algorithms(Slow and Fast)
7. To study and execute Bubble sort method.
8. To study and implement various operations on singly linked list
   (a) Traversing the linked list.
   (b) Insert a node at the front of the linked list.
   (c) Delete a last node of the linked list.
   (d) Searching a Linked list.

9. To study and implement following operations on the doubly linked list.
   (e) Insert a node at the front of the linked list.
   (f) Insert a node at the end of the linked list.
   (g) Delete a last node of the linked list.
   (h) Delete a node before specified position.
10. To study and implement following operations on the circular linked list.
   (e) Insert a node at the end of the linked list.
   (f) Insert a node before specified position.
   (g) Delete a first node of the linked list.
   (h) Delete a node after specified position.
11. Understand the stack structure and execute the push, pop operation on it.
12. Understand the Queue structure and execute the insertion, deletion operation on it.
13. Formulate and demonstrate Transforming Infix Expressions to Postfix Expression using Stack.
14. Formulate and demonstrate the Evaluation of Postfix Expression using Stack.
15. To study and execute Quick sort method.
16. Understand the Tree structure and implement the Pre-order, In-order, post-order traversing operations on it.
17. Understand the concept of Recursion and write a program to calculate factorial of a number using Recursion.
18. Understand the Heap sort and implement it on given data.
19. Understand the Insertion sort and implement it on given data.
20. Understand the Selection sort and implement it on given data.
21. To study and execute Merge sort method.
22. To study and execute Radix sort method.
23. Write a Program to implement the concept of BFS algorithm.
24. Write a Program to implement the concept of DFS algorithm.
25. To study and execute Josephus problem.

3KE08 ANALOG ELECTRONICS & DIGITAL LOGIC DESIGN - LAB

Course Prerequisite: Basic Physics.

Course Objectives:
1. To impart the concepts of analog and digital electronics practically.
2. To provide students basic experimental experiences in the operation of semiconductor device and Digital ICs.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.

Course Outcomes : After successfully completing the lab, the students will be able to
1. Apply practically the concepts of analog and digital electronics.
2. Explain the operation and characteristics of semiconductor devices.
3. Illustrate the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits

List of Experiments:

This is a sample list of Experiments; **minimum 10 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study V-I characteristics of a PN Junction diode in Forward and Reverse bias.
2. To Sketch and Study the input and output characteristics of transistor connected in Common Emitter (CE) configuration..
3. To Sketch and Study the input and output characteristics of transistor connected in Common Base (CB) configuration
4. To Sketch and Study the input and output characteristics of transistor connected in Common Collector (CC) configuration.
5. To plot static characteristics of FET & calculate its parameters g_m, r_d and μ.
6. To implement Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7410, 7411, 7420, 7427, 7432, 7486).
7. Study and verify the truth table of half adder and full adder using logic gates.
8. Study and verify the truth table of half subtractor and full subtractor using logic gates
9. To compare two 4 bits number and verify the output using 4-bit comparator IC 7485.
10. Implementation of 4×1 multiplexer using logic gates.
11. Implementation and verification of Demultiplexer and Encoder using logic gates.
12. Implementation of 4bit parallel adder using 7483 IC.

13. Design and verify the 4 bit synchronous counter.
14. Design and verify the 4 bit asynchronous counter.
15. Verification of truth table of SR, JK, T and D Flip Flops.

List of Experiment beyond syllabus:

1. Design and Implementation of Op-amp as an inverting amplifier.
2. Design and Implementation of Op-amp as a non-inverting amplifier.
3. To design and find frequency of A stable multi-vibrator using IC 555.

3KE09 C-SKILL-LAB I

Course Pre-requisite: Basic knowledge of any Programming Language

Course Objectives:

1. To be able to program design with functions using Python.
2. To understand data and information processing techniques.
3. To understand to Design a program to solve the problems.
4. To be able to access database using python programming.
5. To be able to design web applications using python programming.

Course Outcomes: On completion of the course, the students will be able to

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2. Interpret different Decision Making statements, Functions, Object oriented programming in Python
3. Summarize different File handling operations
4. Explain how to design GUI Applications in Python and evaluate different database operations
5. Develop applications using Django framework or Flask

List of Experiments:

This is a sample list of experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write python program to store data in list and then try to print them.
2. Write python program to print list of numbers using range and for loop
3. Write python program to store strings in list and then print them.
4. Write python program in which an function is defined and calling that function prints Hello World.
5. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
6. Write a program to create, append, and remove lists in python.
7. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
8. Write a program to demonstrate working with tuples in python.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find largest of three numbers.
11. Write python program in which an function(with single string parameter) is defined and calling that function prints the string parameters given to function.
12. Write python program in which an class is define, then create object of that class and call simple print function define in class.
13. Write a Python script that prints prime numbers less than 20.
14. Write a python program to find factorial of a number using Recursion.
15. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.
21. Accessing and working with databases using Python.
22. Create data frame from .csv files and operations on it.
23. Plotting various graphs using Python.
24. Developing basic GUI using Python.
25. Developing web applications using Django framework or Flask

Reference Books :

1. "Core Python Programming", R. NageswaraRao, dreamtech press.
2. "Python Programming A Modular Approach With Graphics, Database, Mobile and Web Applications", Sheetal Taneja, Naveen Kumar, Pearson.
3. Python Web Development with Django By Jeff Forcier, Paul Bissex, Wesley J Chun, Addison-Wesley Professional.
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning
5. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff/O'Reilly Publishers
6. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India.

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SEMESTER IV

4KE01 ARTIFICIAL INTELLIGENCE

Course Prerequisite: Basic concepts of Data Structures, Algorithms, Programming

Course Objectives:
1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem).

Course Outcomes : On completion of the course, the students will be able to
1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem & efficiently solve them.
3. Summarize the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.
4. Apply AI techniques in applications which involve perception, reasoning and learning.
5. Compare the importance of knowledge, types of knowledge, issues related to knowledge acquisition and representation.

Unit I: Introduction to AI (Hours: 7)
Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI,
Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Problem Solving Through AI (Hours: 7)
Introduction, Representation the AI Problems, Production System, Algorithm of Problem Solving, Examples of AI Problems, Nature of AI Problems

Unit III: Uninformed Search Strategies (Hours: 6)
Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit IV: Informed Search Strategies (Hours: 7)
Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis

Unit V: Adversarial Search & Games (Hours: 7)
Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Unit VI: Introduction to Knowledge (Hours: 6)
Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering

Text Books:
1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)

Reference Books:
1. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by RajendraAkerkar (PHI Learning Pvt. Ltd.)

4KE02 COMPUTER NETWORKS

Course Prerequisite: Computer and Data Communication Requirements

Course Objectives:
1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To evaluate the errors using various error detection & correction techniques.
6. To understand network based protocols in data communication and networking.

Course Outcomes: On completion of the course, the students will be able to

1. Describe data communication Components, Networks, Protocols and various topology based network architecture
2. Design and Test different encoding and modulating techniques to change digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion,
3. Explain the various multiplexing methods and evaluate the different error detection & correction techniques.
4. Illustrate and realize the data link control and data link protocols.
5. Describe and demonstrate the various Local area networks and the IEEE standards.

Unit I: Introduction to Data Communication (Hours: 7)

Introduction: Data Communication, Components, Networks, Network types: Local Area Network,Wide Area Network, Switching, The Internet, Accessing the Internet, Standards and Administration: Internet Standards, Internet Administration, Network Models:TCP/IP Protocol Suite,TheOSI Model, Transmission media: Introduction, Guided media & Unguided media-Wireless. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit II: Data link Layer (Hours: 6)

Data Link Layer: Introduction, Nodes & Links, Services , Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC): Random Access, Controlled Access, Channelization.

Unit III: Network Layer (Hours: 7)

Introduction to Network layer Network Layer Services: Packetizing, Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service , Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as Packet Switches

Unit IV: Unit Title: Network Layer Protocol (Hours: 7)

Network Layer Protocols: Internet Protocol (IP),Datagram Format, Fragmentation, Security of IPv4 Datagrams,ICMPV4: Messages, Debugging Tools, ICMP Checksum, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP, Routing algorithms: Distance Vector routing, Link State Routing, IPV6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration, Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses

Unit V: Unit Title: Transport Layer (Hours: 6)

Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking,User Datagram Protocols: User Datagram, UDP Services, UDP Applications,Transmission Control Protocol: TCP Services, TCP Features , Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options, SCTP: SCTP Services, SCTP Features

Unit VI: Unit Title: Application layer (Hours: 7)

Introduction to Application layer:Providing Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication, World wide web and HTTP: World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: Two Connections, Control Connection, Data Connection, Security for FTP, Electronic Mail: Architecture, Web-Based Mail, E-Mail Security, Domain Name System (DNS):Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security of DNS, Network Management: Introduction. Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management, SNMP: Managers and Agents, Management Components, ASN.1: Language Basics, Data Types, Encoding.

Text Book: Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber : Data Communication, McGraw Hill
3. J.Freey : Computer Communication & Networks, AEW Press
4. D. Corner: Computer Networks & Internet, Pearson Education.

4KE03 OPERATING SYSTEM

Course Pre-requisite: Discrete Structures, Data Structure, Any programming Language

Course Objectives:
1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to
1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

Unit I: Introduction to OS : (Hours: 7)
Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads

Unit II: Process Scheduling (Hours: 7)
Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling

Unit III: Process Synchronization (Hours: 6)
Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock

Unit IV: Memory Management (Hours: 7)
Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing

Unit V: Unit Title: File System (Hours: 7)
File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery

Unit VI: Unit Title: I/O System (Hours : 6)
I/O Systems : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations , Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

Text Book : Avi Silberschatz, P.B.Galvin, G.Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.

Reference Books:
1. A.S.Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D. M. Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P. Balkrishna Prasad: “Operating Systems” Scitech Publications (I) Pvt.

4KE04 MICROPROCESSOR & INTERFACING

Course Pre-requisite: Computer Programming and Number System

Course Objectives:
1. To explore 8086 microprocessor and its architecture.
2. To introduce interfacing techniques of 8086 microprocessor.
3. To introduce basics of Internet of Things

Course Outcomes : On completion of the course, the students will be able to
1. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
2. Design and Test assembly language programs using 8086 microprocessor instruction set.
3. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language.
4. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.
5. Explain the basic concepts of Internet of Things

Unit I: 8086 Architecture (Hours: 7)
8086 architecture and pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction Set (Hours: 7)
8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 Instruction Set (Hours: 6)
8086 programming: logical instructions. Shift and rotate instructions and their use in 8086 programming. 8086 flag register and Flag control instructions, compare instruction, control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Subroutines& Macros (Hours: 7)
The 8086 stack segment and stack related instructions. 8086 I/O Address space.Subroutines and related instructions, Parameter passing, Concept of Macros, Status saving on stack.Concept of recursion at assembly program level.8086 Programming using subroutines, recursion and macros.

Unit V: 8086 Interrupt (Hours: 7)
8086 Interrupts types, priority and instructions. Interrupt vector table, External hardware-interrupt interface signals & interrupts sequence. Software interrupts. Non-maskable interrupts. 8086 microprocessor interrupt programming.

Unit VI: Internet of Things (IoT) (Hours: 6)
Internet of things: An overview, IoT conceptual framework, IoT Architectural View, Technology behind IoT, Sources of IoT, M2M communication, Examples of IoT.

Text Books:
1. A. K. Ray & K. M. Bhurchandi: Advanced Microprocessors & Peripherals, Third Edition (TMH).
2. Raj Kamal: Internet of Things, Architecture and Design Principals, McGraw Hill Education (India) Pvt Ltd

Reference Books:
1. W. A. Triebel& Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)
2. Liu & Gibson: The 8088/8086 Microprocessor Architecture Programming and Interface (6/e) (PHI)

4KE05 THEORY OF COMPUTATION

Course Pre-requisite: Discrete Mathematics, Data Structures

Course Objectives:
1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability

Course Outcomes : On completion of the course, the students will be able to
1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines (Hours: 8)
Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar (Hours: 8)
Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages (Hours: 8)
Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata (Hours: 8)
Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines (Hours: 8)
Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability (Hours: 8)
Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory.

Text Books:

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation.
2. Peter Linz: An Introduction to Formal Languages and Automata.

Reference Books:

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. VivekKulkarni : Theory of Computation, OUP India, 2013

4KE06 COMPUTER NETWORK - LAB

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the working principle of various communication protocols
2. To understand and analyze the signal flow in a digital communication system.
3. To analyze error performance of a digital communication system in presence of noise and other interferences.
4. To evaluate the errors using various error detection & correction techniques.
5. To understand network based protocols in data communication and networking.

Course Outcomes : On completion of the course, the students will be able to

1. Analyze performance of various communication protocols
2. Implement Configure various network protocols.
3. Compare IP Address classes of networks.

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study various LAN topologies and their creation using network devices, cables and computers. .
2. To connect the computers in Local Area Network.
3. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
4. Write a program of bit stuffing used by Data Link Layer
5. Write a program to implement CRC(Cyclic Redundancy Check)
6. Write a program to implement Checksum
7. Write a program to implement Sliding window
8. Configure Internet connection and use IP-Config, PING / Tracer and Net stat utilities to debug the network issues.
9. Configuration of TCP/IP Protocols in Windows and Linux.
10. Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.
11. Write a C Program to determine if the IP Address is in Class A, B, C, D, or E
12. Write a C Program to translate Dotted Decimal IP Address into 32 Bit Address.
13. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN(TCP/IP Configuration)

4KE07 OPERATING SYSTEM - LAB

Course Pre-requisite: Basic computer programming

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes : On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

4KE08 MICROPROCESSOR & INTERFACING - LAB

Course Pre-requisite: Computer Programming, Number System

Course Objectives: In this lab student will learn about' Microprocessor and Interfacing' in regards to digital computer, microprocessor architecture, programming with 8086 microprocessor and different peripherals**.**

Course Outcomes : On completion of the course, the students will be able to

1. Analyze the internal workings of the microprocessor
2. Design and develop programs in Assembly Language Programming
3. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
4. Design and Test assembly language programs using 8086 microprocessor instruction set.
5. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language
6. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor

List of Experiments:

This is a sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Installation and Introduction of TASM Assembler.
2. Write a program for addition of two 8-bits numbers and two 16-bits numbers.
3. Write a program for subtraction of two 8-bits numbers and two 16-bits numbers.
4. Write a program for multiplication of two 8-bits numbers.
5. Write a program for division of two 8-bits numbers
6. Write a program to check whether a given number is even or odd.
7. Write a program to demonstrate Logical Group and Shift Rotate Instructions.
8. Write a program to check whether a given number is positive or negative.
9. Write a program to find greatest of two 8-bits signed &unsigned numbers.
10. Block Transfer Program
11. Write a program to find Factorial of a number using loop instruction.
12. Write a program to find cube of a given number using Subroutine.
13. Write a program to find square of a given number using Subroutine.
14. Write a program to find square of a given number using Macro.
15. Write a program to find whether the string is palindrome or not.
16. To convert BCD Number Program
17. Write a program to perform Reverse of the String
18. Write a program to transfer 10-bytes from one memory bank to another memory bank.
19. Program for sorting an array for 8086 microprocessor.
20. To write an assembly language program to arrange the given numbers in descending order.
21. Program for searching for a number/character in a string for 8086 microprocessor.

4KE09 C-SKILL-LAB II

Course Pre-requisite: Basic knowledge of scripting language, Programming language,
Basic understanding of Electronic concepts.

Course Objectives: To develop an ability to design and implement static and dynamic website and to develop embedded systems with the help of Raspberry Pi/Ardino.

Course Outcomes : On completion of the course, a student will be able to

1. Develop client server program and web applications
2. Make use of project-based experience for web application development.
3. Create embedded systems using Raspberry Pi/Ardino

List of Experiments:

This is a sample list of Experiments, **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to PHP and configure it to work with Apache Web Server.
2. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
3. Create your class timetable using table tag.
4. Create user Student feedback form (use textbox, text area , checkbox, radio button, select box etc.)
5. Create your resume using HTML tags also experiment with colors, text , link , size and also other tags you studied.
6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Develop a JavaScript to display today's date.
8. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
10. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
11. Write a PHP program to display a digital clock which displays the current time of the server.
12. Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix.
13. Write a PHP program to sort the student records which are stored in the database using selection sort.
14. Study and Install IDE of Arduino and different types of Arduino.
15. Write program using Arduino IDE for Blink LED.
16. Write Program for RGB LED using Arduino.
17. Study the Temperature sensor and write a Program for monitor temperature using Arduino.
18. Study and Implement RFID, NFC using Arduino. • Study and implement MQTT protocol using Arduino.
19. Study and Configure Raspberry Pi.
20. WAP for LED blink using Raspberry Pi.
21. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
22. Create Smart Plugs with Arduino and Raspberry Pi.
23. Interfacing digital sensors with raspberry pi.
24. Creating a webpage to control I-O devices, Reading data from sensor and passing to web page.
25. Implement a program to access Analog sensor via wifi with HTML Web server.

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SYLLABUS OF B.E. SEM. III & IV (I.T.) [C.B.C.S.]

Semester-III

3IT01/3KS01/3KE01 ENGINEERING MATHEMATICS-III

Course Objectives:-

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Apply Laplace transform to find solution of linear differential equations. And solve problems related to Fourier Transform
- Compute and interpret the correlation coefficient.
- Compute the Analytic function and Complex Analysis.
- Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and linear differential equations .
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Demonstrate the basic concepts of probability and statistics.
5. Apply the knowledge of Complex Analysis.
6. Apply the knowledge of vector calculus to solve physical problems.

SECTION-A

UNIT-I: **Ordinary differential equations**:- Complete solution, Operator D, Rules for finding commplementary function, the inverse operator, Rules for finding the particular integral, Method of variation of parameters, Cauchy's and Legendre's linear differential equations. (7)

UNIT-II: **Laplace Transform:-** Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Initial and final value theorem, Convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function . (7)

UNIT-III: **a) Applications of Laplace Transform:-** Solution of Linear differential equations, Simultaneous differential equation by Laplace transform method

b) Fourier Transform:- Definition, standard forms, Fourier transforms, properties of Fourier transforms, Convolution theorem, Fourier sine and Fourier cosine transforms and integrals, inverse Fourier transforms.(7)

SECTION-B

UNIT-IV: **a) Partial differential equation** of first order of following form:- (i)f (p,q) = 0; (ii) f (p,q,z) = 0; (iii) f (x, p) = g (y,q); (iv) P p + Qq = R (Lagranges Form); (v) z = px + qy + f(p,q) (Clairauts form)

b) Statistics Curve fitting: Least Square Method, Coefficient of Correlations, Lines of Regression. (7)

UNIT-V: **Complex Analysis: -** Functions of complex variables, Analytic function, Cauchy- conditions, Harmonic function, Harmonic conjugate functions, Milne's Method, conformal mappings (translation, rotation, magnification and bilinear transformation), Expansion of function in Taylor's and Laurent's series. (7)

UNIT–VI: **Vector calculus**:- Scalar and vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion Formulae (without proof), line, surface, volume integrals, irrotational Solenoidal Vector fields. (7)

Text Books:
1. Elements of Applied Mathematics Vol. II by P. N. Wartikar and J.N. Wartikar,
2. Higher Engg. Mathematics by B.S. Grewal.

Reference Books:
1. Advancing Engg. Mathematics by E.K.Kreyzig.
2. A text book of Differential Calculus by Gorakh Prasad.
3. A Text Book of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.
4. Engineering Mathematics by Ravish R Singh, Mukul Bhatt.

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3IT02 Discrete Structure & Graph Theory

Course Objectives:

- Increase Critical thinking and analytical problem-solving skills and awareness of computer related ethics to discrete Mathematical Logic.
- Apply appropriate discrete mathematical concepts and operations to interpret data and to solve problems.
- Identify problem and analyze it in terms of its significant parts and the information needed to solve problems based on sets, relation, function and recursion.
- Formulate and evaluate possible solutions to problem and select the chosen solution based on Boolean algebra.
- Construct graphs and trees, interpret them, and draw appropriate conclusion.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Identify basic terminology of Mathematical Logic, Theory of inference & Predicate calculus.
- Identify, illustrate, and solve engineering problems on the basis of set theory.
- Identify and Design an Algebraic Structures and groups
- Examine and formulate the concept of Lattices & Boolean Algebra to solve engineering problems.
- Design and interpret data using graphs, trees and related algorithms.

UNIT I : Mathematical Logic : Statements & Notation , Connectives , Normal forms , The Theory of Inference for the Statement Calculus , Predicate Calculus , The Inference Theory of the Predicate Calculus.

UNIT II: Set Theory : Basic concepts of Set Theory , Representation of Discrete Structure, Relation and ordering, Functions , Recursion.

UNIT III : Algebraic Structures : Algebraic Systems , Semi groups and Monoids , Grammars and Languages, Polish expression & their compilation , Groups , Semi groups, Application of Residue Arithmetic to Computers.

UNIT IV: Lattice & Boolean Algebra: Lattices as Partially Ordered Sets, Boolean Algebra, Boolean Functions, Representation of Boolean Functions , Minimization of Boolean Functions.

UNIT V: Graph Theory: Basic concepts of Graph Theory , Paths, Reachability & Connectedness, Matrix representation of graphs , Storage Representation and Manipulation of Graphs, Coloring Graphs.

UNIT VI: Trees, Tree Searching, Minimal spanning trees, Simple Precedence Grammars, , rooted tree, expression tree, B tree, Distance between spanning trees of a graph. PERT and Related Techniques.

Text Book : J.P.Trembley, R.Manohar :"Discrete Mathematical Structures with Application to Computer Science" 1988 (Tata McGraw Hill)

REFERENCE BOOKS:

1 G Shankar Rao, "Discrete Mathematical Structures", New Age International, 2002 ISBN:81-224-1424-9.
2 Kenneth H. Rosen, " Discrete Mathematics and its Applications", 7th Edition, McGraw Hill Edition.
3. S.K. Chakraborty & B.K.Sarkar ;"Discrete Mathematics" OXFORD.
4. Bernard Kolman,Robert C.Busby, Sharon Ross: "Discrete Mathematical Structures" Third Edition PHI.

3IT03 OBJECT ORIENTED PROGRAMMING

Course Objectives:

- Study of the basic concepts of Java such as operators, classes, objects, inheritance, packages and exception handling.
- Study of concepts like enumerations, generics, logging, API, assertions, Applets, AWT.
- Preparing the students to learn Object Oriented Programming Methodology.

Course Outcomes:

- Apply Object Oriented approach to design software.
- Implement programs using classes and objects.
- Specify the forms of inheritance and use them in programs.
- Analyze polymorphic behavior of objects.
- Design and develop GUI programs.
- Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming: Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. **Java Programming Constructs:** Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control.

Unit II: Classes and Objects: Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

Unit III: Inheritance: Inheritance vs. Aggregation, Polymorphism, Method Overloading Method Overriding, super keyword, final keyword, Abstract class. **Interfaces, Packages and Enumeration:** Interface, Packages, java.lang package, Enum type.

Unit IV: Exception: Introduction, Exception handling Techniques, User-defined exception, Exception Encapsulation and Enrichment. **Input/ Output:** The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V: Applets: Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, get Document Base () and get Code Base() methods.

Unit VI: Event Handling: Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. **Abstract Window Toolkit:** Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Text field and Textarea, Container Class, Layouts, Menu, Scrollbar.
Text Book: Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.

Reference Books:
1. Herbert Schildt: Java Complete References (McGraw Hill)
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Khalid Mughal: A Programmer's Guide to Java Certification, 3rd Edition (Pearson)
4. Liang: A text Book of Java Programming, (PHI).

3IT04 ASSEMBLY LANGUAGE PROGRAMMING

Course Objectives :

1. Able to understand the architecture and organization of microprocessor 8086/8088 .
2. Able to understand different addressing modes & instruction format of 8086 & apply in 8086 programming.
3. Able to understand instruction set, control flow instruction and apply the fundamentals of assembly level programming of microprocessor through use of any Open Source Software.(TASM,NASM etc.)
4. Able to understand stack, subroutine. Recursion & apply in 8086 programming.

Course Outcomes ;
After successful completion of this course the student will be able to
1. To draw and explain internal architecture of 8086 with its register organization.
2. Able apply instruction format 7 addressing modes in 8086 programming.
3. Able to apply control flow instruction in 8086 programming through use of any Open Source Software.(TASM,NASM etc.)
4. Able to apply stack & subroutine concept in 8086 programming.

Unit I: Microprocessor 8086 architecture-BIU and EU, pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 instructions: logical instructions, Shift and rotate instructions 8086 programming: 8086 flag register and Flag control instructions control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Stack and Subroutines,8086 stack segment and stack related instructions. 8086 I/O Address space, Subroutines and related instructions, parameter passing, Concept of Macros, Status saving on stack. Concept of recursion at assembly Program level. 8086 programming using subroutines, recursion and macros.

Unit V: 8086 I/O: Types of input output, isolated I/O interface, input output data transfers, I/O instructions and bus cycles. Programmable Peripheral Interface 8255 PPI: pin diagram, internal organization, modes of operation.

Unit VI: 8086 Interrupt Mechanism, types and priority , Interrupt vector table, Interrupt Instructions, External hardware-interrupt interface signals & interrupts sequence. Programmable Interrupt Controller 8259: Block & pin diagram, internal architecture, Software interrupts, Nonmaskable interrupt, Internal Interrupt functions.

Text Book: Avtar Singh & Walter A. Triebel: The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware, and Applications, PHI, 2003.

References:

1. Barry B. Brey : The Intel Microprocessor Architecture, Programming & Interfacing (6/e)(PHI)
2. John P Uffenbeck, "8086/8088 Families: Designing, Programming and Interfacing". Prentice Hall
3. D. V. Hall: Microprocessors and Interfacing, TMH.

3IT05 ANALOG AND DIGITAL ELECTRONICS

Course Objectives :

- To understand the basic operation and applications of analog devices such as BJT and JFET
- To introduce analog ICs like Op-Amp and Timer
- To study and develop skills to design basic combinational and Sequential logic circuits
- To lay foundation for understanding computer architecture and organization

Course Outcomes :

On completion of the course learner will be able to-

- Understand the basic applications of BJT.
- Get acquainted with analog ICs like Op-Amp IC-741 and Timer IC-555
- Discriminate the working of sinusoidal and non-sinusoidal waveform generators.
- Apply the concept of K-map to simplify logic expressions.
- Design and implement Combinational circuits
- Explore the applications of Sequential circuits

UNIT I:

Introduction to Analog Circuits: Transistor as an amplifier. Need of biasing, Potential divider bias circuit, Faithful amplification of CE amplifier, Transistor as an electronic switch, Construction and working of JFET.

UNIT II:

Operational Amplifier: Block diagram of Op-Amp, ideal Op-Amp parameters. Applications of op-amp: Inverting & Non-Inverting Amplifier, Voltage follower, Summing Amplifier, Subtractor, Comparator.

UNIT III:

Wave Generators:

Transistorized Oscillators: Barkhausen Criterion, R-C Phase Shift Oscillator, Transistor crystal oscillator Timer IC 555: Block diagram**,** working, Astable multivibrator, Monostable multivibrator.

UNIT IV: Introduction to Digital Circuits: Logic gates, Standard logic expression forms, SOP, POS, Logic expression realization & minimization using K-map (upto 4 variables only). Half Adder, Full Adder, Half subtractor, Full subtractor.

UNIT V: Logic Circuits: Difference between Combinational and Sequential circuits, Code convertors (BCD, Excess-3 and Gray), Multiplexers, De-multiplexers and Decoders.

Flip Flops: SR flip-flop, JK flip-flop, D flip-flop and T flip-flop.

UNIT VI: Sequential Circuits: Difference between Asynchronous & Synchronous sequential circuits, Asynchronous counters, Mod counter, Up-Counter, Down-Counter. Working of shift Registers, SISO, SIPO, PISO and PIPO. Application of Shift Register as a Ring Counter.

Text Books:

1. V.K.Mehta, Rohit Mehta: Principles of Electronics (S.CHAND)
2. Gayakwad R.A.: Op-Amps & Linear Integrated circuits (PHI)
3. Jain R.P. Modern Digital Electronics (TMH)

Reference Books:

1. N.N.Bhargava, D.C.Kulshreshtha, S.C.Gupta: Basic Electronics & Linear circuits, (TTTI)
2. S. Salivahanan: Electronics Devices & circuits, Third Edition
3. John P. Hayes: Introduction to Digital Logic Design{Pearson)
4. Anand Kumar: Fundamentals of Digital Circuits (PHI)

3IT06 OBJECT ORIENTED PROGRAMMING - LAB

Practical based on the syllabus of Object Oriented Programming (3IT03)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Object Oriented Programming (3IT03)

1. Write a program to demonstrate various data-types used in java and also perform the type casting.
2. Demonstrate the use of this keyword in java.

3. Write a program in java to demonstrate various OOP'S (Inheritance, Polymorphism, and Abstraction) concepts in java.
4. Create User defined Packages in Java
5. Write a program in java to set the priority of thread in order.
6. Demonstrate the strings are immutable in java and create mutable strings in java.
7. Write a program in java which demonstrates the exception caught because of invalid input.
8. Write java program to create a registration form using AWT.
9. Write a Java program to demonstrate the use of AWT components namely buttons, labels, text boxes, menus with event handling.
10. Write a program in java to copy certain text of one file to another newly created file in java using java I/O operations.
11. Write a program in java to connect java to oracle or MySql Database using JDBC drivers
12. Demonstrate the various List interfaces in java.
13. Write a program in java to show use of generic classes and methods

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

3IT07 ASSEMBLY LANGUAGE PROGRAMMING - LAB

Practical based on the syllabus of Assembly Language Programming (3IT04)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Assembly Language Programming (3IT04). Study experiments are highly discouraged.

1. Executing various debugging commands.
2. Write a program to manipulate the two given operands with general arithmetic operators +, -, *, /
3. Write a program in TASM to store given a number XY i.e. 0X in BX register and 0Y in CX register
4. Program for block transfer from one segment to another segment
5. Write a program in TASM to find out no. of positive and negative numbers from a given series of a signed no.
6. Program to sort the given array in ascending and descending order.
7. Program for Addition/Subtraction of 2 numbers using FAR/NEAR procedure
8. Program to find out Factorial of any given number using recursive procedure.
9. Program to add two BCD numbers.
10. Program for BCD to HEX conversion.
11. Program for HEX to BCD conversion.
12. Program to display System Date/Time.
13. Program to find whether no. is Prime or not.
14. Execute various commands on 8086 Microprocessor Trainer kit.

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

3IT08 ANALOG & DIGITAL ELECTRONICS - LAB

Practical based on the syllabus of Analog & Digital Electronics (3IT05)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Analog & Digital Circuits (3IT05)

1) To study the input and output characteristics of transistor connected in Common Emitter (CE) configuration.
2) Implementation of Op-amp as an inverting amplifier.
3) Implementation of Op-amp as a non-inverting amplifier.
4) Study of Astable Multivibrator using IC 555 and find the frequency of output square wave.
5) To study and verify the Truth Table of different Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7427, 7432, 7486 etc.).
6) Study and verify the truth table of Half adder and Full adder using logic gates.
7) Study and verify the truth table of Half Subtractor and Full Subtractor using logic gates
8) Implementation of 4bit parallel adder using IC-7483 .

9) Study the working of Multiplexer using one of the ICs like 74151A, 74152, 74153, 74157.
10) Study the working of De-Multiplexer and Decoder using one of the ICs like74138,74154,74156
11) Study the working and Verification of truth table of SR, JK, T and D Flip Flops.
12) Implementation of 3 bit asynchronous counter using JK Flip Flop.
13) Implementation of 3 bit Shift Register using D Flip Flop.

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

3IT09 COMPUTER SKILL LAB - I

This practical lab must cover the following aspects for Python:

1. Basics for python programming that consists of the study of various data types in Python, implementation of control structures and loops, functions (pre-defined and user defined), file handling commands and functions.
2. The lab must also cover the concepts related to networking using python.
3. OOP concepts study and its programming using python libraries.
4. The lab must cover the part of UI deigning using python (Django, Flask, etc.).
5. The plotting of graphs using various libraries such as (matplotlib, seaborn, etc.).
6. The lab must also give a brief introduction regarding the a concept of machine learning or a learning algorithm implementation.
7. An introduction to the data science track can be given by conducting and including an experiment on data manipulation using (Numpy, Pandas, etc.)

The following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on Python, R etc.

1. To study the various data types in Python.
2. To study dictionaries, data frames and tuples in Python
3. To study the control structures and loops in Python.
4. To study the various Functions (pre-defined and User Defined) in Python.
5. To study the various File handling and i/o in Python.
6. To study the concepts related to Networking in Python.
7. To study various OOP concepts using Python.
8. To study UI design using various libraries in Python.
9. To Study Plotting of Graphs using the various libraries in Python.
10. To study basic data manipulation using Python Libraries.
11. To study a learning algorithm using Python.
12. Mini Project (based on all the above mentioned concepts)

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

SEMESTER - IV

4IT01 COMPUTER ORGANIZATION & ARCHITECTURE

Course Objectives :

- How Computer Systems work & the basic principles.
- Instruction Level Architecture and Instruction Execution.
- The current state of art in memory system design.
- How I/O devices are accessed and its principles.
- To provide the knowledge on Instruction Level Parallelism.
- To impart the knowledge on micro programming.
- Concepts of advanced pipelining techniques.

Course outcomes :

- Ability to understand the basic structure of computer including functional units, addressing modes, stacks, queues, subroutines, etc.
- Ability to understand the basic processing unit of computer, execution of a complete instruction.
- Ability to understand about input/output organization of computer including interrupt, DMA, buses, interfaces, etc.
- Ability to understand the concepts of RAM, ROM, cache memory, virtual memory.
- Ability to understand number representation, Booth's algorithm, different peripheral devices.

Unit-I	Basic structure of computer: hardware & software, program sequencing. concept of memory locations & address. Main memory operation. instructions & instruction sequencing. Addressing modes. basic I/O operations. Stacks. queues & subroutines.
Unit-II	Processing Unit: fundamental concepts. execution of a complete instruction. hardwired control, performance consideration. Micro-programmed control; microinstructions.
Unit-III	I/O organization: accessing I/O devices, interrupts, direct memory access, bus arbitration: centralized and distributed. I/O hardware: processor bus (Synchronous & Asynchronous).
Unit-IV	Memory Unit: basic concepts, semiconductor RAM memories, internal organization, static & dynamic RAMs, ROMs. speed, size & cost considerations.
Unit-V	Cache memories: performance considerations. Virtual memories, address translation. Multiprocessor: The Use of Multiprocessors, Symmetric Multiprocessor and Clusters.
Unit-VI	Arithmetic; number representation. Design of fast adders, signed addition and subtraction. Multiplication of positive numbers, sequential multiplication, fast multiplication, Booths' algorithm for multiplication, integer division, restoring and non-restoring division.

Text-Books:

1. "Computer Organization" 5th Edition by V.Carl Hamacher & S.Zaky, McGraw-Hill (ISE).
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.

References:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill.
3. Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.
4. "Structured Computer Organization", 5th Edition by Tenanbaum A.S., Pearson Education.

4IT02 DATA COMMUNICATION & NETWORKING

Course Objectives :

- To understand the fundamental concepts of computer networking.
- To familiarize the students with basic taxonomy and terminology of data communication.
- To introduce the students to advanced networking concept and network reference models.
- To lay foundation for understanding the students to network design, simulation, modeling and analysis.

Course Outcomes :

- On completion of the course learner will be able to-
- Understand the principles and fundamental concept of computer networks.
- Understand and explain data communication system with its techniques and applications.
- Identify various error detection and correction techniques in data transmission.
- Evaluating the network addresses and learning routing mechanism protocols.
- Design TCP connection and analyze upper OSI layer functions and services.
- Explore the network design and its applications to digital world.

UNIT-I: Introduction (Hours: 06)
Types of Network; Network Topologies; OSI Vs TCP\IP Model; Network Devices: Bridge, Switch, Router; Transmission Medium: Guided media, Unguided media; Time and Frequency Domain, Types of Signals: Analog, Digital, Composite, Periodic, Aperiodic Signal.

UNIT-II: Data Encoding and Multiplexing (Hours: 06)
Data conversions: Digital-to-Digital, Analog-to-Digital, Digital-to-Analog; Configuring DTE-DCE Interface, Manchester and Differential Manchester encoding; Shannon Capacity; Multiplexing: FDM, WDM, TDM; Multiplexing Application: Mobile Telephone System.

UNIT-III: Data Link Layer (Hours: 06)
Design Issues: Services to Network Layer, Framing, Flow control; Error Control: Parity Bits, Hamming Code, Cyclic Redundancy Check (CRC); Data Link Protocols: Synchronous and Asynchronous Protocols, CSMA/CD, WAN Connectivity Protocols: PPP and HDLC.

UNIT-IV: Addressing and Routing (Hours: 06)
Switching Techniques, IPv4 Addressing Scheme, IPv6 addressing Overview, Subnetting, Evaluating Network Address by router, Routing Protocols: Distance Vector, Link State; Ethernet Networks: Token Ring, FDDI.

UNIT-V: Networking and Services (Hours: 06)
Transport Layer Services, TCP/UDP Protocols, TCP Segment, TCP Connection, Upper OSI Layers: Session Layer, Presentation Layer, Application Layer functions and services.

UNIT-VI: Network Design and Applications (Hours: 06)
Network Layout, Network Design Metrics, Network design traceability, WWW, DNS, Voice over IP; Introduction and Comparison of mobile network system and its applications: 2G, 3G, 4G.

Text Books:

1. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw-Hill, Publications.
2. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8.

Reference Books:

1. William Stallings, “Data & Computer Communications”, (6/e) Pearson Education.
2. Wehrle, Klaus, Gunes, Mesut, Gross, James, "Modeling and Tools for Network Simulation", Springer, ISBN: 978-3-642-12330-6
3. J.Freey, “Computer Communication & Networks”, AEW Press.
4. Bhushan Trivedi, “Computer Networks” OXFORD.

4IT03 OPERATING SYSTEM

Course Objectives :

- To introduce basic concepts and different types of operating systems, concept of process and thread.
- To understand the scheduling of processes and concurrency control with synchronization
- To understand the concept deadlock and basic Memory Management
- To understand Virtual Memory management concepts.
- To understand the concept of File System management.
- To understand the concept of Disk Management, Scheduling and Protection and Security.

Course Outcomes :

- Fundamental understanding of the role of Operating Systems, concept of a process and thread.
- To apply the concept of process scheduling and concurrency control to different scenarios.
- To understand and apply the concept deadlock and basic Memory Management
- To realize virtual memory management schemes.
- To realize the concept of File system management.
- To understand and apply the concept of Disk Management, Scheduling and Protection and Security.

Unit I :
Introduction: Operating System (OS definition),OS Evolution, OS Services, Process Concept ,Process Scheduling ,Operations on Processes, Cooperating & Inter-process Communication, Threads: Multithreading Models, Threading Issues ,Java Threads. (6 Hrs)

Unit II : CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synch.: The Critical Section Problem ,Synchronization Hardware, Semaphores, Monitors. (6 Hrs)
Unit III : Deadlocks: Definition& Characterization. Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. Memory Management: Background, Swapping, Contiguous Memory Allocation schemes ,Paging, Segmentation. (6 Hrs)

Unit IV : Virtual Memory: Background, Demand Paging, Process Creation, Page Replacement policies, Allocation of Frames, Thrashing. (6 Hrs)

Unit V : File-System Interface: Directory Structure, File-System Mounting, File Sharing, Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods Free-Space Management, File Recovery. (6 Hrs)

Unit VI: I/O Systems: Overview, I/O Hardware, Application I/O Interface , Kernel I/O Subsystem, Transforming I/O to Hardware Operations. Disk Scheduling ,Disk Management ,Swap-Space Management ,RAID Structure. (6 Hrs)

Text Book:
Avi Silberschatz, P.B.Galvin, G.Gagne: "Operating System Concepts" (6th Edn) John Wiley & Sons Publication.

Reference Books:

1. A.S Tanenbaum "Modern Operating Systems" Pearson Education.
2. William Stallings "Operating Systems" Prentice-Hall.
3. D M Dhamdhere "Operating Systems" Tata McGraw-Hill.

4IT04 DATA STRUCTURE

Course Objectives :

- To understand the role of Data Structure in memory management
- To acquire knowledge of different types of data structures like: array, types of array, linked list, stacks, queues, trees, and their memory representation
- To learn the fundamental concept of data structure and emphasize the importance of it in developing and implementing efficient algorithms
- To analyze complexity of algorithms in terms of time and memory space
- To Understand data structure, types of data structure and their common applications
- To study the use of algorithms to perform the operations on data structure such as traversing, insertion, deletion, searching, sorting and merging
- To understand importance and applications of linear and non-linear data structure
- To obtained knowledge and skill of Sorting Methods such as: Bubble Sort, Quick Sort, Merge Sort, Selection Sort and Bucket Sort
- To Learn and acquire knowledge about the use of Tree and Graph in applications

Course Outcomes :

- Define fundamental features of array, linked-list, stack, queue, tree and graph
- Write the algorithms to perform various operations such as: Search, Insertion, Deletion, Sort etc
- Implement algorithms for various operations on linear and non-linear data structure
- Classify the linear data structures such as Array, Linked-List, Stack, Queue and non-linear data Structures such as Tree and Graph with their applications
- Implement linear data structures: Array, Linked-list, Stack, Queue using suitable language C,C++
- Implement non-linear data structure: Tree, Graph using C or C++
- know different types of sorting methods and their algorithms
- Choose appropriate algorithm for Searching 9: Perform operations of traverse, insertion, deletion.

UNIT I :
Algorithms and Linear Data Structure: Array Introduction: Data, Data Structure and their types. Algorithm and their Complexity, String processing operations, Pattern matching algorithms: fast and slow. Array: Types of array, memory representation of array, Algorithm and operations on Array: traversing, searching, insertion, deletion. Applications (7 Hrs)

UNIT II:
Algorithms and Linear Data Structure: Linked List (LL) Linked List: Features, Representation of Linked List in memory using array, Types of LL, Algorithms and operations onto LL: traversing, insertion, deletion, searching & their implementation, Applications (5 Hrs)

UNIT III
Linear Data Structure: Stack and Queue Stack: Definition, Memory representation of Stacks using array and Linked List. Operations on to Stack: Push and Pop. Stack Applications: Recursion, Solve arithmetic expressions, tower of Hanoi etc. Queue: Definition, Memory representation of Queue using array and Linked List, Types of queue, Operations on queues: Traversing, Insertion, Deletion, Searching. Applications (6 Hrs)

UNIT IV
Sorting, Sorting Methods and its Algorithms Simple Sorting Algorithms, Bubble Sort, Quick Sort, Insertion Sort, Selection Sort, Heap Sort, Merge Sort, Bucket Sort and their Applications. (6 Hrs)

UNIT V :
Non-Linear Data Structure: Tree Trees: Terminology, Types, Binary trees and their representation in memory, traversing in binary trees using stacks. Binary Search Trees, searching, inserting and deleting nodes in binary trees, Heap tree, Path length & Huffman's algorithm, Spanning Trees, Basic concepts of Kruskal's and Prim's Algorithm, B+ tree. (6 Hrs)

UNIT VI :
Non-Linear Data Structure: Graph Graph: Definitions, Sequential and Linked-list representation of Graphs, Warshalls' algorithm, Bridges in graph, Johnsons algorithm. Graph Traversals: Breadth First Search, Depth First Search, Topological Sort, Shortest Path Algorithms: Unweighted Shortest Paths, Basic concepts of Dijkstra's Algorithm. (6 Hrs)

Text Books:

1. Mark Allen Weiss, 'Data Structures and Algorithm Analysis in C++', 3/e, Florida International University, ISBN 0-321-37531-9
2. Seymour Lipschutz, 'Theory & Problems of Data Structures', Schaum's Outline Series (Mc Graw-Hill) International Editions.

Reference Books:

1. John Hubbard: 'Schaum's Outline DataStructure with C++', ISBN-13: 978-0071353458
2. Jean-Paul Tremblay, Paul G. Sorenson, P. G. Sorenson, 'An Introduction to Data Structures With Applications', (McGraw-Hill Computer Science Series), ISBN-13: 978-0070651579
3. Ellis Horowitz, Sartaj Sahni, Rajasekaran , 'Computer Algorithms/C++', 2nd edition, 2019.

4 IT 05 SOCIAL SCIENCES & ENGINEERING ECONOMICS

SECTION - A

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy. (8)

Unit II : Indian Parliament : Composition and powers, President of India : Election and Powers. Council of Ministers and Prime Minister (8)

Unit III : Impact of Science and Technology on culture and Civilization. Human Society: Community Groups. Marriage and Family: Functions, Types and problems. (8)

SECTION - B

Unit IV: Production : Factors of production, Laws of return, Forms of Business Organisation. (8)

Unit V : Banking : Functions of Central and Commercial Banks. Introduction to GST, Market : Forms, perfect, imperfect competition and monopoly. (8)

Unit VI: Nature and scope of Economics : Special significance of Economics to Engineers. Economics of Development : Meaning, Characteristics of under development, obstacles to Economic growth and vicious circle of poverty. (8)

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. C N Shankar Rao: Sociology, S.Chand and Co.
3. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
4. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
5. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
6. E.Kuper : Economics of W.R. Development, McGraw Hill Co.,
7. Brij Kishore Sharma. : The Constitution of India, PHI.
8. Mahajan : The Constitution of India, S.Chand, New Delhi.
9. Maclaver and Page : Principle of Sociology.
10. Davis K. : Human Society
11. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi P.M.Sundharam
12. Dhingra I.C. : Indian Economy
13. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

4IT06 DATA COMMUNICATION & NETWORKING - LAB

Practical based on the syllabus of Data Communication & Networking (4IT02)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Data Communication & Networking Lab (4IT02)

1. To study computer Networks and Its topology.
2. To study and implement digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion
3. To implement and check flow control in DLL
4. To Study and Implement Asynchronous Protocols
5. To Study and Implement synchronous Protocols
6. To implement packet switching in network
7. To implement Circuit switching in network
8. To Demonstrate and study working of various networking devices like switch,router etc

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

IT07 OPERATING SYSTEM - LAB

Practical based on the syllabus of Operating System (4IT03)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Operating System (4IT03)

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

1. To study basics of shell programming.
2. To study the creation of process using fork system call.
3. To implement FCFS scheduling algorithm.
4. To implement SJF scheduling algorithm.
5. To implement Priority scheduling algorithm.
6. To implement Round Robin scheduling algorithm.
7. To implement Best Fit algorithm of memory management.
8. To implement First Fit algorithm of memory management.
9. To implement FCFS disk scheduling algorithm.
10. To implement SCAN disk scheduling algorithm.
11. To implement the process synchronization using semaphore concept.

4IT08 DATA STRUCTURE - LAB

Practical based on the syllabus of Data Structure (4IT04)

Following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on the syllabus of Data Structure (4IT04)

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

1. Program to implement Bubble Sort.
2. Program to implement Linear Search & Binary Search
3. Program to perform various operations on Linked List.
4. Program to perform various operations on Stack.
5. Program to reverse the elements in the stack using recursion.
6. Program to perform various operations on Queue.
7. Program to convert a given infix expression into its postfix Equivalent.
8. Program to create a binary search tree of characters.
9. Programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Insertion Sort
    b. Selection Sort
10. Program to implement graph traversal algorithms:
    a) Depth first traversal b) Breadth first traversal

4IT09 COMPUTER SKILL LAB - II

The following list is an indicative list and the subject teacher is free to design his/her own list of experiments based on Raspberry Pi with Adrino etc.

1 Familiarization with Raspberry Pi and perform necessary software installation.
2 To interface LED with Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3 To interface Push button/Digital sensor (IR/LDR) with Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4 To interface DHT11 sensor with Raspberry Pi and write a program to print temperature and humidity readings.
5 To interface OLED with Raspberry Pi and write a program to print temperature and humidity readings on it.
6 To interface Bluetooth with Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7 To interface Bluetooth with Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8 Write a program on Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
9 Write a program on Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
10 To install MariaDB database on Raspberry Pi and perform basic SQL queries.
11 Connect to MariaDB through Python 3 program
12 Explore Scientific Python 3 ecosystem and perform image processing with NumPy and Matplotlib

Students are advised to explore the Virtual Labs Developed by Ministry of Human Resource Development Government of India available at http://www.vlab.co.in/broad-area-computer-science-and-engineering

REFERENCE BOOKS:

1) "Raspberry Pi by Example"by Ashwin Pajankar: PACKT PUBLICATIONS
2) "Raspberry Pi Amazing Projects " by Ashwin Pajankar: PACKT PUBLICATIONS
3) "20 Easy Raspberry Pi Projects: Toys, Tools, Gadgets, and More!" By : Rui Santos , Sara Santos No Starch Press
4) " IoT Fundamental" by Devid Hanes Publishers: CISCO
5) "Raspberry Pi Cookbook for Python Programmers" by Tim Cox Publishers: PACKT

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SYLLABUS FOR BE ELECTRICAL ENGINEERING / (ELECTRICAL &ELECTRONICS ENGINEERING) / ELECTRICAL ENGINEERING (ELECTRONICS & POWER) SEMESTER PATTERN CHOICE BASED CREDIT GRADE SYSTEM

3EE01 /3 EP01 /3EX01 ENGINEERING MATHEMATICS - III

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Apply Z Transform to solve of various Linear Difference equations with constant coefficients.
5. Apply the knowledge of vector calculus to solve physical problems.
6. Demonstrate the basic concepts of probability and statistics.

SECTION-A

UNIT-I:

Ordinary Differential Equations: - Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. Applications to electrical circuits. (7)

UNIT-II:

Laplace Transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Laplace transform of Periodic Function, Impulse Function, Unit Step Function. Solution of linear differential equation using Laplace transform. (7)

UNIT-III:

a) Partial differential equation of first order and first degree of following type-

(i) $f(p, q) = 0$; (ii) $f(p, q, z)=0$; (iii) $f(p, q, x, y) = 0$; (iv) $Pp + Qq = R$ (Lagrange's Form); (v) Clairaut form $Z = px + qy + f(p, q)$

b) Fourier transforms- Definition, standard forms, inverse Fourier transform Fourier sine and Fourier cosine transforms and integrals. (7)

SECTION-B

UNIT-IV:

a) Difference Equation:- solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.

b) Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z- transforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms. (7)

UNIT-V:

Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), Irrotational and Solenoidal vector fields, Line Integral, Stokes and Divergence Theorem. (7)

UNIT-VI:

Statistics & Probability: Axioms, conditional probability, Bay's theorem, mathematical expectations, probability distributions: Binomial, Poisson and Normal. (7)

Books Recommended:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar
2. Advancing Engineering Mathematics by E. K. Kreyzig.
3. Advance Engineering Mathematics by B. S. Grewal
4. Integral Transforms by Goyal & Gupta.
5. Statistical Methods by S.G. Gupta

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3EE02/3 EP02/3EX02 ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes:

After completing this course studentwill be able to:

1. Analyze electric and magnetic circuits using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Unit I:

a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources., Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input, generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:

Network Theorems: Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :

Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:
a] **Transformation of a Circuit into s-domain:** LaplaceTransformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution ofLinear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :
Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :
Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.
2. Circuit and Network Analysis, SudhakarShyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.

3EE03/3 EP03/3EX03 ELECTRICAL MACHINE - I

Course Outcomes:

After Completing this course, students will be able to:

1. Explain the construction and working of DC Machines.
2. Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generators.
3. Demonstrate the various characteristics, starting, speed control and braking operation on DC motors
4. Analyze the performance of DC machines by conducting the various tests on it.
5. Determine the parameters of equivalent circuits, performance parameters of single phase transformer and merits & demerits of autotransformer
6. Explain the construction, working, different connections, applications and testing of three phase transformer.

Unit I :
D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II :
D.C. Generators: Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D. C. Generators as per Indian standard.

Unit III :
D.C. Motors: Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.

Unit IV :
Single phase Transformer: Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard. Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V :
Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.

Unit VI :
Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

Text Book:
Electrical Machines by D P Kothari & I J Nagrath Published by Tata McGraw-Hill Book Comp. New Delhi.

Reference Books:
1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)
2) H. Cotton: Advance Electrical Technology, (Wheeler publication)
3) Indian Standard Guide for testing DC Machine. IS: 9320-1979, (Indian Standards Institution, New Delhi.)
4) Indian Standard Specification for safety transformer. IS: 1416-1972, (Indian Standards Institution, New Delhi.)

3EE04/3 EP04 – ENERGY RESOURCES AND GENERATION

Course Outcomes:
A student, on completion of this course, will be able to:
1. Explain the operation of Thermal, Hydro, Nuclear and Diesel power plants.
2. Summarize solar energy conversion, solar radiation measuring instruments, wind energy conversion and their applications.
3. Outline the principle and operation of fuel cells, ocean & tidal energy conversion, and other non-conventional energy resources.
4. Determine the various factorsand curves related to electrical load & generating plant.

Unit I:
Conventional and non conventional energy sources, Indian Energy Scenario.
Thermal and hydro power plant: Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash &coal handling plant, advantages & disadvantages
Layout of Hydro power plant, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages.

Unit II :

Nuclear and Diesel power plant: nuclear fission and fusion, Layout of Nuclear power plant, Selection of site, Functions of different components of nuclear plant, types of nuclear reactors , advantages & disadvantages of different nuclear reactors, nuclear waste disposal., safety measures.

Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages.

Unit III :

Solar Energy and its measurement: Solar cell, array & module, Solar constants, solar radiation at earth's surface, Solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, types of solar collectors, energy balance equation and collector efficiency.

Unit IV:

a]Fuel cells: Chemistry applied to fuel cells, principle and operation ,classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cell system.

b]Wind energy :Basic principle of wind energy conversion, wind data and energy estimation, selection of site ,basic components of wind energy conversion system ,classification of WEC systems ,generating system, applications of wind energy.

Unit V :

Ocean, Tidal & Other non-conventional energy resources: Ocean energy resources, ocean energy routes, ocean thermal energy conversion, basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in single and double basin tidal system,. Operating principles of energy from biomass, energy from biogas, geothermal energy, MHD power generation, energy from urban and rural waste.

Unit VI :

Load-Generation factors: connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, load curve, chronological load curve, load duration curve, energy load curve, energy duration curve, load survey, base load and peak load station.

Text Book: Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Solar energy by S.P.Sukhatme Tata McGraw Hill Publication
3. Principles of Power System by V.K.Mehta, S.Chand publication.
4. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.

3EE05/3 EP05ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes:

After successfully completing the course, the students will be able to :

1. Demonstrate the knowledge of semiconductor physics and PN Junction Diode
2. Analyze the rectifier and regulator circuits.
3. Analyze the operational parameters of BJT
4. Analyze various multistage amplifier circuits
5. Demonstrate the knowledge of JFET, MOSFET, UJT and their operational parameters

UNIT-I:

P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current , drift current, mobility and resistivity, generation and recombination of carriers, PN junction diode , zener diode, zener diode as voltage regulator, Numericals based on voltage regulator (line and load regulation, Numericals based on resistivity, conductivity, mass action law)

UNIT-II:

Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, clipping and clamping, Numericals based on clipping and clamping

UNIT-III:

Theory and Analysis of Bipolar Junction transistor, 'H' Parameter, methods of biasing, their needs, 'Q' and stability factors, compensation techniques.

UNIT-IV

Study of typical transistor amplifier circuits i) Emitter follower, ii) Darlington emitter follower. iii) Bootstrap emitter follower, iv) RC coupled amplifier, v) Transformer coupled amplifier, vi) Cascaded amplifier, vii) Direct coupled amplifier, viii) Cascade stage.

UNIT-V :

FETs (JFET & MOSFET): Types, Characteristics and parameters (u, gm &Rds), Applications of FET amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

UNIT-VI :

Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

Text Book: Millman's Electronic Devices & Circuits by J.Millman, C.Halkias, Satyabrata Jit TMH 3rd ed, 2nd reprint 2011.

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.

3EE06/3 EP06/3EX06 ELECTRICAL CIRCUIT ANALYSIS LAB

Minimum eight experiments based on the syllabus content of 3EP02 Electrical Circuit Analysis. The intensive list of experiment is given below.

1. Verification of output response of series R-C circuit for step input
2. Study of dot convention and determination of
   A) Mutual inductance
   B) Coupling coefficient of b transformer
3. Verification of Mesh and Node analysis.
4. Verification of Superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of reciprocity theorem.
8. Study of Milliman's theorem& verification.
9. Verification of Norton's theorem.
10. Determination of ABCD parametersT-network &Π-network.
11. Study of Tie set and Cut set schedule for a given network.
12. MATLAB simulation for o/p verification of any theorem.
13. Determination of Z and Y parameter.
14. Determination of hybrid parameter.

3EE07/3 EP07/3EX07 ELECTRICAL MACHINES - I LAB.

Minimum eight experiments based on the syllabus content of 3EP03Electrical Machines – I.

The indicative list of experiments is given below.

1. Plot the OCC of DC generator and find its critical resistance and critical speed.
2. To study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.
5. Speed Control of DC Shunt motor by armature control & Field Control method.
6. Perform the direct load test on DC series/shunt/compound motor to plot its performance characteristics, and determine its efficiency and speed regulation.
7. Conduct the Swinburn's test on DC machine to estimate its performance at any desired load condition.
8. Conduct the Hopkinson's test on DC Machine to analyze its performance.
9. Perform Electric Braking Operation on DC shunt Motor.
10. Conduct the Polarity test and Ratio test on transformer
11. Calculate the Equivalent circuit parameters of single-phase transformer by performing OC & SC test on itand determine its efficiency and voltage regulation.

12. Perform the direct load test on single phase/three phase transformer and determine its efficiency and voltage regulation.
13. Conduct back to back test (Sumpner's test)on two single phase transformers and determine the temperature rise.
14. Conduct the magnetic balance test on three phase transformer.
15. Conduct the vector group test on three phase transformer.
16. Conversion of three phase to two phase supply system using Scott Connection
17. Capture the waveform of inrush current of single phase/three phase transformer using DSO.

Reference:

S.G.Tarnekar, P.K.Kharbanda, S.B.Bodkhe, S.D.Naik and D.J.Dahigaonkar"Laboratory Courses in Electrical Engineering", S. Chand & Co. New Delhi, 2013.

3EE08/3 EP08/3EX08 ELECTRONIC DEVICES & CIRCUITS LAB

Minimum eight experiments based on the syllabus content of 3EP05Electronic Devices & Circuits. The intensive list of experiment is given below.

1. To study and verify V-I characteristics of semiconductor diode
2. To study and verify V-I characteristics of Zener diode.
3. To verify the performance of half wave rectifier circuit with and without filter.
4. To verify the performance of full wave bridge rectifier circuit and determination of load regulation.
5. To verify the performance of Zener voltage regulator.
6. To verify characteristics of bipolar junction transistor
7. To study and perform C-E amplifier gain with variation of load resistance.
8. To study and verify the characteristics of FET
9. To study UJT as a relaxation oscillator
10. To study phase shift oscillator & determine frequency of oscillation
11. To study characteristics of MOSFT
12. To study clipper circuits using diodes
13. To study clamper circuits using diodes
14. To study and verify operation of cascade amplifiers
15. To verify operation of transistor as a switch

3EE09/3 EP09/3EX09 ELECTRICAL TECHNOLOGY - LAB

Perform minimum Eight practicals / demonstration from the following list and prepare the report as a term work for this laboratory.

1. Introduction to standard symbols used in wiring diagrams
2. Introduction to different wiring accessories.
3. Demonstration of different types of wirings eg. Domestic wiring, commercial wiring, Industrial wiring.
4. Connection of Staircase wiring, Godown wiring, fluorescent lamp. Ceiling fan, air cooler etc
5. Domestic wiring diagrams
6. Connections of switch board, MCB and energy meter
7. Testing and electrical Maintenance of domestic appliances like lamps, electric iron, heater, geyser, air cooler, fan, microwave-oven, induction heater, etc.
8. Insulation resistance and earth resistance measurement
9. Conduct the load survey for domestic/commercial /Industrial consumers
10. Illumination system Design (selection of type and number of lamps required for any location)
11. Calculation of Energy bill for LT & HT consumers.
12. Safety precautions while working with electrical system
13. Demonstration of first aid treatment after getting electric shock.
14. Study of various components of solar power plant.
15. Design calculation of small capacity roof top solar power plant

SEMESTER – IV

4EE01/4EP01/4EX01 ELECTROMAGNETIC FIELDS

Course outcomes :

At the end of the course the student should be able to:

1. Demonstrate the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field.
4. Apply Maxwell's equation in different forms (differential and integral) to diverse engineering problems.

Unit I :
Review of Vector Analysis: Cartesian, cylindrical and spherical co-ordinate systems, vector algebra and vector calculus. Line integral and multiple integrals. Gauss theorem.

Unit II :
Electrostatics: Coulomb's law, electric field, Gauss flux theorem in integral and differential form. Electrostatics potential, Poison and Laplace equations.

Unit III :
Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

Unit IV :
Magnetic fields: Biot-Savart law, Ampere's law in integral and differential form. Continuity equation, time of relaxation. Vector and Scalar magnetic potential, electric current, J vector..

Unit V
Magnetic fields in materials: magnetic dipole equivalent volume and plane section curve. H vector, magnetization vector M, boundary conditions between magnetic materials, inductance, Electromagnetic Energy.

Unit VI :
Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

Text Book: "Engineering Electromagnetics", by Hayt W.H. Tata Mc-Graw Hill publication

Reference Books:

1. Electromagnetic fields by TVS Arun Murthy S Chand & Co
2. Principles and applications of Electromagnetic fields by Plansycollin , Mc-Graw Hill Books Co.
3. Foundations of electromagnetic theory by John Reitz, Addison Wesley Pub Co.
4. Basic electromagnetic field by Herbert Neelf, Harber International education
5. Introduction to electromagnetic, Derucy and Johnson, Mc-Graw Hill Books Co.

4EE02/4EP02/4EX02 ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Course Outcomes:

A student completing this course, should be able to:

1. Classify the various measuring instruments like PMMC, MI, Electrodynamometer, and Induction type instruments for measurement of current, voltage, power, and energy.
2. Demonstrate the construction & working of Instrument Transformers and special purpose meters.
3. Analyze various methods for measurement of resistance, inductance, and capacitance using AC/DC bridges.
4. Explain the working of various Digital measuring instruments.
5. Explain the generalized Instrumentation system & working of different transducers.

Unit-I: Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Analog Ammeter, Voltmeter, Electrodynamic type Construction, ,theory of operation, torque equation, errors, merits and demerits of each type.

Unit II : Wattmeter and Energy meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type.
Analysis of three phase balanced load:- Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III : Instrument transformers- C.T.and P.T., Importance, theory and construction, phasor diagram, causes of errors, testing, and applications.
Special Instruments- Frequency meter, Power factor meter, Phase sequence indicator, Synchroscope and Stroboscope.

Unit IV: Measurement of circuit parameters- Different methods of measurement of low, medium, high value of resistance, sensitivity and accuracy of different methods. AC and DC bridges, Wheat -stone, Kelvin, Maxwell ,Wein , Hay , De-Sauty ,Schering , Owen , Anderson's bridge.

Unit V:
Digital methods of measurements, Introduction to A/D, D/A techniques , F/V and V/F conversion techniques , Digital voltmeter (DVM), ammeter, wattmeter, multi-meter and Electronic energy meter, Sources of error, Inherent error in digital meters.

Unit VI:
Generalized Instrumentation system- characteristics of measurement and Instrumentation system. Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Force and torque transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers. Elastic-members (Bellows, Bourdon tube, Diaphragm)

Text Book: A.K. Sawhney, 'Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai& Co (P) L

Reference Books:
1. E.W.Golding&F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler& Co.
2. Albert D. Helfrick& William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, .
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education.
4. Bouwens, A.J., "Digital Instrumentation", McGraw Hill.

4EP03 CONTROL SYSTEMS

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I : Introduction to automatic control
Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components
Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis:

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability
Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods
Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response : Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

Books Recommended:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai & co.

4EP04 NUMERICAL METHODS & OPTIMIZATION TECHNIQUES

Course Outcome:
After completing this course students will be able to

1. Solve linear and Simultaneous Equations with the help of Numerical Methods.
2. Apply various Numerical methods to fit the curve.
3. Solve Numerical differentiation, integration, and Differential Equations.
4. Solve linear, non linear and dynamic optimization problem by various methods.
5. Determine the optimum scheduling by using CPM and PERT.

Unit I:
(a)Absolute, relative and percentage errors and analysis, Solution of Algebraic and Transcendental equations: Bisection Method, False Position method, Newton Raphson methods, Successive approximation method

(b) **Solution of Simultaneous Algebraic Equations**: matrix inverse method, Gauss elimination method,Iterative method-Jacobi's Method, Gauss Seidel Method; Eigen values of a matrix.

Unit II:
(a) Curve fitting by Least Square Method, Correlations and Regression.

(b) Newton's forward and backward interpolation method, Newton's Divided Difference Method, Lagrange's Interpolation method, Interpolation with Cubic Splines.

Unit III:
Numerical differentiation by Taylor series method, Maximum and minimum values, Numerical Integration by Trapezoidal, Simpsons one third and three eight rules, Numerical solution to differential equations by Taylor Series, Euler's method, RungeKutta second and fourth order methods

Unit IV:
Basics of Optimization Techniques, Linear programming - standard form, definitions and theorems, graphical method, simplex method, two phase simplex method, balanced and unbalanced transportation problems.

Unit V:
Non linear programming: unimodal function, Fibonancci search method and golden section method, Steepest descent method, conjugate gradient method, unconstraint optimization, direct search method.

Unit VI:
Dynamic programming: multistage decision processes, principle of optimality, sub optimization, calculus and tabular method of solution, conversion of final value problem into initial value problem.

CPM and PERT: introduction, Network representation of project, critical path, Probability of completion of project, optimum scheduling by CPM, crashing of project.

Books Recommended:

Text Books:
1. Introductory Methods of Numerical Analysis; S. S. Sastry (PHI)
2. Engineering Optimization – Theory & Practice; S. S. Rao (New Age International Pvt. Ltd.)

Reference Books:

1. Mathematical Statistics by J. N. Kapoor, Tata McGraw Hill Pub. Co. Ltd
2. Numerical Methods in Engineering and Science; B. S. Grewal (Khanna Publishers)
3. PERT and CPM- Principles & Application; L. S. Srinath (Affiliated East-West press pvt. Ltd)
4. Optimization for Engineering Design - Algorithms and Examples byKalyan Moy Deb, PHI Pub.

4EE04/ 4EP05 /4EX04 ANALOG AND DIGITAL CIRCUITS

Course Outcomes:

After completing the course, students will be able to

1. Explain the principles of operational amplifiers, parameters of op-amp
2. Illustrate the linear and nonlinear applications of op-amp
3. Demonstrate the knowledge of Voltage regulator and Timer ICs
4. Describe the working of Logic families andtheir applications.
5. Demonstrate the knowledge of combinational and sequential circuits and its application

Unit I:
Introduction to IC's: Operation amplifier; Block schematic internal circuits, Level shifting, overload protection, study of IC 741 op-amp, Measurement of op-amp parameter.

Unit II:
Linear and Non-linear Application of Op-amp: Inverting and non inverting amplifiers, voltage follower, integrator, differentiator differential amplifier, op amp as adder subtractor, op amp as a log and antilog amplifier

Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using op-amps.

Unit III:
Other linear IC's : Block schematic of regulator IC 723, and its applications, study of 78XX, 79XX and its applications, SMPS, Block schematic of timer IC 555 and its applications as a timer, a stable, mono stable, bistable multivibrator and other applications, Operation of phase lock loop system and IC 565 PLL, its application.

Unit IV: Basic Logic Circuits : Logic gate characteristics, NMOS inverter, propagation delay, NMOS logic gate, CMOS inverter, CMOS logic gates, BJT inverter, TTL, NAND gate, TTL output, state TTL logic families, ECL circuits, composition logic families.

Unit V:
Combinational Digital Circuits: Standard gate assemblies, Binary adder, Arithmetic functions, Digital comparator, Parity check generator, Decoder / demultiplexer, Data selector / multiplexer, Encoder

Unit VI:
Sequential Circuits and Systems: Bistable Latch, Flip-Flop clocked SR,J-K, T, D type shift Registers, counter. Design using filp-flops, Ripple and synchronous types, application of counters

Books Recommended:-

Text Book: Millman, Microelectronics, 2nd Ed., McGraw Hill.

Reference Books:
1. Gayakwad, Op-Amp & LLG, 2nd Ed.
2. Malvino& Leach, Digital Principles & Applications, 4th Ed., McGraw Hill.
3. K.B.Botkar, Integrated Electronics (Khanna Publishers.)

4EE07/ 4EP06 /4EX06 ELECTRICAL MEASUREMENTS & INSTRUMENTATION- LAB

Minimum eight experiments based on the syllabus content of 4EP02 Electrical Measurements & Instrumentation. The intensive list of experiment is given below.

1. Measurements of Low resistance by using Kelvin double Bridge.
2. Measurements of Medium resistance by Ammeter Voltmeter method/Wheatstone Bridge
3. Measurement of High resistance by Loss of Charge method.
4. Measurement of Insulation resistance by using Megger

5. Measurement of unknown Inductance using Maxwell Bridge/Hay Bridge/Anderson Bridge
6. Measurement of Unknown Capacitance by Desauty Bridge/Schering Bridge
7. Measurement of frequency using Wien Bridge
8. Extension of range of ammeter using shunt/CT.
9. Extension of range of voltmeter using multiplier/PT.
10. Calibration of Wattmeter by Phantom loading
11. Calibration of energy meter to detect the error in it.
12. Measurement of active & reactive power measurement in 1 phase / 3 phase circuit.
13. Measurement of rotational speed using stroboscope
14. Conversion of non electrical quantity into its equivalent electrical quantity using proper transducer.
15. Compare the accuracy, preciseness, sensitivity of Analog & Digital Measuring Instruments.

4EP07 CONTROL SYSTEM LAB

Minimum eight experiments based on the syllabus content of 4EP03Control System. The intensive list of experiment is given below.

1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination Of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination Of Frequency Response of Given R-C Network
7. Determination Of Transfer Function of A.C. Tacho-Generator
8. Experimental Study Of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

4EE09/ 4EP08 /4EX08 ANALOG AND DIGITAL CIRCUIT LAB

Minimum eight experiments based on the syllabus content of 4EP05Analog & Digital Circuit. The intensive list of experiment is given below.

1. To Plot Frequency Response Of Non-Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
2. To Plot Frequency Response Of Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
3. To Perform Op-Amp as Differentiator Using IC741 .
4. Design The Circuit for Supplying 5V,25mA As A Low Voltage Regulator Using IC 723
5. Verification Of Truth Table Of Various Logic Gates Using ICs
6. To Study and Verify The Operation Of SR and MS ,JK Flip Flop
7. To Verify The Operation Of Multiplexer Using IC74153.
8. To Design And Verify Function Of Decade Counterusing IC 7490
9. To Verify The Truth Table Of 4 Bit Comparator
10. To Perform Op-Amp As Integrator Using IC741
11. A stable Multi-vibrator Using IC 555timer
12. To Study And Verify The Operation Of Half-Adder And Full-Adder.

4EE10/ 4EP09 /4EX09 ELECTRONIC TECHNOLOGY LAB

Perform Minimum Eight experiments / demonstration based on the following contentand prepare the report as a term work for this laboratory.

- **Study of electronic Components:** Identification of components, name, types, symbol, size, rating and application.
- **Handling Electronic Components:** Finding values and testing (using DMM), test working condition, fault detection.
- **Working with breadboards:** understanding the breadboards for component mounting, working with small circuits on breadboard

- **Soldering:**Soldering skill tips- use of proper soldering Iron, Metal, Flux**,** Cleaning, Tinning etc., mounting components on zero PCB, testing of small circuits mounted on zero PCB. De-soldering of components
- **PCB Layout and design:** Understanding different PCBs, Working on PCB Layout (Software), PCB etching, drilling on PCB, Mounting components on PCB, Working with small circuits on PCB and their testing
- **Electronic circuit Simulation:** Familiarizing with the simulation software, simulation and result validation of simple circuit with software.

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SYLLABUS OF B.E. (ELECTRICAL) SEM. III & IV [C.B.C.S.]

3EE01/3 EP01/3EX01 ENGINEERING MATHEMATICS -III

Course Outcomes:
After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Apply Z Transform to solve of various Linear Difference equations with constant coefficients.
5. Apply the knowledge of vector calculusto solve physical problems.
6. Demonstrate the basic concepts of probability and statistics.

UNIT-I:
(a) **Statistics:**Introduction, Curve fitting by method of least square, change of scale, fitting of straight line and parabola, correlation, regression. Application of statistics to electrical engineering.

(b) **Probability**: Axioms, conditional probability, Bay'stheorem,mathematical expectations, probability distributions:Binomial, Poisson and Normal.Application of probability to electrical engineering.

UNIT-II:
(a)Partial differential equation (PDE)of first order and first degree of following type-

(i) f (p, q) = 0; (ii) f (p, q, z) =0; (iii) f (p, q, x, y) = 0; (iv) Pp + Qq =R (Lagrange's Form); (v) Clairaut form Z = px + qy + f(p, q) . Applications of PDE to electrical circuits.

(b)DifferenceEquation: -Solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.Applications of difference equations to electrical engineering.

UNIT-III:
Laplace Transforms: Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Laplace transform of Periodic Function, Impulse Function, Unit Step Function. Solution of linear differential equation using Laplace transform.

UNIT-IV:
Fourier Transforms- Definition, standard forms, properties of Fourier transform,inverse Fourier transform, Fourier Transform of some basic functions.Fourier transform of Periodic Function, Impulse Function, Unit Step Function.Fourier cosine transforms. Applications of Fourier Transforms in electrical engineering.

UNIT-V:
Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z-transforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms.

UNIT-VI:
Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, Line Integral, Stokes and Divergence Theorem. Application of Vector calculus to electromagnetics.

Text Book: Elements of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.

Reference Books:

1. Statistical Methods by S.G. Gupta
2. Advance Engineering Mathematics by B.S.Grewal
3. Integral Transforms by Goyal & Gupta.

3EE02/3 EP02/3EX02 ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes:

After completing this course student twill be able to:

1. Analyze electric and magnetic circuits using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Unit I:
[a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources., Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input, generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

[b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:
Network Theorems: Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :
Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:
a] **Transformation of a Circuit into s-domain:** LaplaceTransformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution ofLinear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :
Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :
Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.
2. Circuit and Network Analysis, SudhakarShyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.

3EE03/3 EP03/3EX03 ELECTRICAL MACHINES – I

Course Outcomes:

After Completing this course, students will be able to:

1. Explain the construction and working of DC Machines.
2. Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generators.
3. Demonstrate the various characteristics, starting, speed control and braking operation on DC motors
4. Analyze the performance of DC machines by conducting the various tests on it.
5. Determine the parameters of equivalent circuits, performance parameters of single phase transformer and merits & demerits of autotransformer
6. Explain the construction, working, different connections, applications and testing of three phase transformer.

Unit I :
D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II :
D.C. Generators: Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D. C. Generators as per Indian standard.

Unit III :
D.C. Motors: Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.

Unit IV :
Single phase Transformer: Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard.

Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V :
Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.

Unit VI :
Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

Text Book: Electrical Machines by D P Kothari & I J Nagrath TMH. New Delhi.

Reference Books:

1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)
2) H. Cotton: Advance Electrical Technology, (Wheeler publication)
3) Indian Standard Guide for testing DC Machine. IS: 9320-1979, (Indian Standards Institution, New Delhi.)
4) Indian Standard Specification for safety transformer. IS: 1416-1972, (Indian Standards Institution, New Delhi.)

3EE04/3 EP04 ENERGY RESOURCES AND GENERATION

Course Outcomes:
A student, on completion of this course, will be able to:

1. Explain the operation of Thermal, Hydro, Nuclear and Diesel power plants.
2. Summarize solar energy conversion, solar radiation measuring instruments, wind energy conversion and their applications.
3. Outline the principle and operation of fuel cells, ocean & tidal energy conversion, and other non-conventional energy resources.
4. Determine the various factorsand curves related to electrical load & generating plant.

Unit I :
Conventional and non conventional energy sources, Indian Energy Scenario.
Thermal and hydro power plant: Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash &coal handling plant, advantages & disadvantages
Layout of Hydro power plant, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages.

Unit II :
Nuclear and Diesel power plant: nuclear fission and fusion, Layout of Nuclear power plant, Selection of site, Functions of different components of nuclear plant, types of nuclear reactors , advantages & disadvantages of different nuclear reactors, nuclear waste disposal., safety measures.
Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages.

Unit III :
Solar Energy and its measurement: Solar cell, array & module, Solar constants, solar radiation at earth's surface, Solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, types of solar collectors, energy balance equation and collector efficiency.

Unit IV :
a]Fuel cells: Chemistry applied to fuel cells, principle and operation ,classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cell system.

b]Wind energy :Basic principle of wind energy conversion, wind data and energy estimation, selection of site ,basic components of wind energy conversion system ,classification of WEC systems ,generating system, applications of wind energy.

Unit V :
Ocean, Tidal & Other non-conventional energy resources: Ocean energy resources, ocean energy routes, ocean thermal energy conversion, basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in single and double basin tidal system,. Operating principles of energy from biomass, energy from biogas, geothermal energy, MHD power generation, energy from urban and rural waste.

Unit VI :
Load-Generation factors: connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, load curve, chronological load curve, load duration curve, energy load curve, energy duration curve, load survey, base load and peak load station.

Text Book : Generation of Electrical Energy by B.R.Gupta, Eurasia Publishing House, New Delhi.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Solar energy by S.P.Sukhatme Tata McGraw Hill Publication
3. Principles of Power System by V.K.Mehta, S.Chand publication.
4. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.

3EE05/3 EP05ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes:

After successfully completing the course, the students will be able to :

1. Demonstrate the knowledge of semiconductor physics and PN Junction Diode
2. Analyze the rectifier and regulator circuits.
3. Analyze the operational parameters of BJT
4. Analyze various multistage amplifier circuits
5. Demonstrate the knowledge of JFET, MOSFET, UJT and their operational parameters

UNIT-I:
P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current , drift current, mobility and resistivity, generation and recombination of carriers, PN junction diode , zener diode, zener diode as voltage regulator, Numericals based on voltage regulator (line and load regulation, Numericals based on resistivity, conductivity, mass action law)

UNIT-II:
Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, clipping and clamping, Numericals based on clipping and clamping

UNIT-III:
Theory and Analysis of Bipolar Junction transistor, 'H' Parameter, methods of biasing, their needs, 'Q' and stability factors, compensation techniques.

UNIT-IV :
Study of typical transistor amplifier circuits i) Emitter follower, ii) Darlington emitter follower. iii) Bootstrap emitter follower, iv) RC coupled amplifier, v) Transformer coupled amplifier, vi) Cascaded amplifier, vii) Direct coupled amplifier, viii) Cascade stage.

UNIT-V :
FETs (JFET & MOSFET): Types, Characteristics and parameters (u, gm &Rds), Applications of FET amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

UNIT-VI :
Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

Text Book :
Millman's Electronic Devices & Circuits by J.Millman, C.Halkias, Satyabrata Jit TMH 3rd ed, 2nd reprint 2011.

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.

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3EE06/3 EP06/3EX06 ELECTRICAL CIRCUIT ANALYSIS - LAB

Minimum eight experiments based on the syllabus content of 3EE02/3 EP02/3EX02Electrical Circuit Analysis. The intensive list of experiment is given below :

1. Verification of output response of series R-C circuit for step input
2. Study of dot convention and determination of
    A) Mutual inductance
    B) Coupling coefficient of b transformer
3. Verification of Mesh and Node analysis.
4. Verification of Superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of reciprocity theorem.
8. Study of Milliman's theorem& verification.
9. Verification of Norton's theorem.
10. Determination of ABCD parametersT-network &Π-network.
11. Study of Tie set and Cut set schedule for a given network.
12. MATLAB simulation for o/p verification of any theorem.
13. Determination of Z and Yparameter.
14. Determination of hybrid parameter.

3EE07/3 EP07/3EX07 ELECTRICAL MACHINES - I LAB

Minimum eight experiments based on the syllabus content of 3EE03/3 EP03/3EX03Electrical Machines – I.

The indicative list of experiments is given below.

1. Plot the OCC of DC generator and find its critical resistance and critical speed.
2. To study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.
5. Speed Control of DC Shunt motor by armature control & Field Control method.

6. Perform the direct load test on DC series/shunt/compound motor to plot its performance characteristics, and determine its efficiency and speed regulation.
7. Conduct the Swinburn's test on DC machine to estimate its performance at any desired load condition.
8. Conduct the Hopkinson's test on DC Machine to analyze its performance.
9. Perform Electric Braking Operation on DC shunt Motor.
10. Conduct the Polarity test and Ratio test on transformer
11. Calculate the Equivalent circuit parameters of single-phase transformer by performing OC & SC test on itand determine its efficiency and voltage regulation.
12. Perform the direct load test on single phase/three phase transformer and determine its efficiency and voltage regulation.
13. Conduct back to back test (Sumpner's test)on two single phase transformers and determine the temperature rise.
14. Conduct the magnetic balance test on three phase transformer.
15. Conduct the vector group test on three phase transformer.
16. Conversion of three phase to two phase supply system using Scott Connection
17. Capture the waveform of inrush current of single phase/three phase transformer using DSO.

. **Reference:** S.G.Tarnekar, P.K.Kharbanda, S.B.Bodkhe, S.D.Naik and D.J.Dahigaonkar"Laboratory Courses in Electrical Engineering", S. Chand & Co. New Delhi, 2013.

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3EE08/3 EP08/3EX08 ELECTRONIC DEVICES & CIRCUITS - LAB

Minimum eight experiments based on the syllabus content of 3EE05/3 EP05/3EX04Electronic Devices & Circuits. The intensive list of experiment is given below :

1. To study and verify V-I characteristics of semiconductor diode
2. To study and verify V-I characteristics of Zener diode.
3. To verify the performance of half wave rectifier circuit with and without filter.
4. To verify the performance of full wave bridge rectifier circuit and determination of load regulation.
5. To verify the performance of Zener voltage regulator.
6. To verify characteristics of bipolar junction transistor
7. To study and perform C-E amplifier gain with variation of load resistance.
8. To study and verify the characteristics of FET
9. To study UJT as a relaxation oscillator
10. To study phase shift oscillator & determine frequency of oscillation
11. To study characteristics of MOSFT
12. To study clipper circuits using diodes
13. To study clamper circuits using diodes
14. To study and verify operation of cascade amplifiers
15. To verify operation of transistor as a switch

3EE09/3 EP09/3EX09 ELECTRICAL TECHNOLOGY - LAB

Perform **minimum Eight** practicals /demonstrations from the following list and prepare the report as a term work for this laboratory.

1. Introduction to standard symbols used in wiring diagrams
2. Introduction to different wiring accessories.
3. Demonstration of different types of wirings eg. Domestic wiring, commercial wiring, Industrial wiring.
4. Connection of Staircase wiring, Godown wiring, fluorescent lamp. Ceiling fan, air cooler etc
5. Domestic wiring diagrams
6. Connections of switch board, MCB and energy meter
7. Testing and electrical Maintenance of domestic appliances like lamps, electric iron, heater, geyser, air cooler, fan, microwave-oven, induction heater, etc.
8. Insulation resistance and earth resistance measurement
9. Conduct the load survey for domestic/commercial /Industrial consumers
10. Illumination system Design (selection of type and number of lamps required for any location)
11. Calculation of Energy bill for LT & HT consumers.
12. Safety precautions while working with electrical system
13. Demonstration of first aid treatment after getting electric shock.
14. Study of various components of solar power plant.
15. Design calculation of small capacity roof top solar power plant

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SEMESTER IV

4EE01/4EP01/4EX01 ELECTROMAGNETIC FIELDS

Course outcomes :

At the end of the course the student should be able to:

1. Demonstrate the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field.
4. Apply Maxwell's equation in different forms (differential and integral) to diverse engineering problems.

Unit I :
Review of Vector Analysis: Cartesian, cylindrical and spherical co-ordinate systems, vector algebra and vector calculus. Line integral and multiple integrals. Gauss theorem.

Unit II :
Electrostatics: Coulomb's law, electric field, Gauss flux theorem in integral and differential form. Electrostatics potential, Poison and Laplace equations.

Unit III :
Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

Unit IV :
Magnetic fields: Biot-Savart law, Ampere's law in integral and differential form. Continuity equation, time of relaxation. Vector and Scalar magnetic potential, electric current, J vector..

Unit V : Magnetic fields in materials: magnetic dipole equivalent volume and plane section curve. H vector, magnetization vector M, boundary conditions between magnetic materials, inductance, Electromagnetic Energy.

Unit VI :
Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

BOOKS RECOMMENDED:

Text Book: Engineering Electromagnetics by Hayt W.H. Tata Mc-Graw Hill publication.

Reference Books:
1. Electromagnetic fields by TVS Arun Murthy S Chand & Co

2. Principles and applications of Electromagnetic fields by Plansycollin , Mc-Graw Hill Books Co.

3. Foundations of electromagnetic theory by John Reitz, Addison Wesley Pub Co.

4. Basic electromagnetic field by Herbert Neelf, Harber International education

5. Introduction to electromagnetic, Derucy and Johnson, Mc-Graw Hill Books Co.

4EE02/4EP02/4EX02 ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Course Outcomes:

A student completing this course, should be able to:

Classify the various measuring instruments like PMMC, MI, Electrodynamometer, and Induction type instruments used for measurement of current, voltage, power, and energy.

1. Demonstrate construction & working of Instrument Transformers and special purpose meters.
2. Analyze various methods for measurement of resistance, inductance, capacitance using bridges.
3. Explain the working of various Digital measuring instruments.
4. Explain the generalized Instrumentation system & working of different transducers used for measurement of various non electrical quantities.

Unit-I :
Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Analog Ammeter, Voltmeter, Electrodynamic type Construction, ,theory of operation, torque equation, errors, merits and demerits of each type.

Unit II :

Wattmeter and Energy meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type. Analysis of three phase balanced load:- Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III :

Instrument transformers- C.T.and P.T., Importance, theory and construction, phasor diagram, causes of errors, testing, and applications. Special Instruments- Frequency meter, Power factor meter, Phase sequence indicator, Synchroscopeand Stroboscope.

Unit IV:
Measurement of circuit parameters- Different methods of measurement of low, medium, high value of resistance, sensitivity and accuracy of different methods. AC and DC bridges, Wheat -stone, Kelvin, Maxwell , Wein , Hay , De-Sauty ,Schering , Owen , Anderson's bridge.

Unit V:
Digital methods of measurements, Introduction to A/D, D/A techniques , F/V and V/F conversion techniques , Digital voltmeter (DVM), ammeter, wattmeter, multimeter and Electronic energy meter, Sources of error, Inherent error in digital meters.

Unit VI:
Generalized Instrumentation system- characteristics of measurement and Instrumentation system. Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Force and torque transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers. Elastic-members (Bellows, Bourdon tube, Diaphragm)

Text Book: A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpat Rai & Co (P) Ltd.

Reference Books:

1. E.W.Golding&F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler& Co.
2. Albert D. Helfrick& William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, .
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education.
4. Bouwens, A.J., "Digital Instrumentation", McGraw Hill

4EE03/4EX03 POWER SYSTEM – I

Course Outcomes:

At the end of the course the student should be able to:

1. Calculate the transmission line parameters like resistance, inductances and capacitances.
2. Explain the various configurations of line conductors and their effects on the line parameters.
3. Estimate the electrical characteristics of transmission lines and hence to evaluate the performance of the lines.
4. Draw the single line diagram of any electrical system.
5. Perform the per unit calculation of any electrical system.
6. Apply knowledge of voltage control and power factor improve methods practically.
7. Perform the load flow or power flow methods to any electrical system.
8. Design HV, EHV lines, insulators used.
9. Evaluate the mechanical parameters of line supports.
10. draw the various underground cable configurations and to calculate their electrical parameters.

Unit I
Transmission line parameters: Calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on capacitance, interference with communication lines.

Unit II
Electrical characteristics of transmission line : V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal Π and nominal T representations, Ferranti effect, corona phenomenon, effect of corona. Representation of power systems: per unit system and one-line reactance diagrams

Unit III
Voltage control and power factor improvement: Receiving and sending end power circle diagrams, methods of voltage control and power factor improvement, use of static VAR generators and synchronous phase modifiers.

Unit IV
Load flow studies: Load flow problem, classification of buses, network modelling, Y-bus matrix, load flow equation, Gauss-Seidel and Newton-Raphson methods, and comparison of these methods.

Unit V
Mechanical design: Materials used, types of insulators, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Line supports for LV, HV and EHV, sag calculation.

Unit VI
Underground cables: Material used for conductor & insulation, different types of cables and their manufacture, parameters of underground cable, grading of cable.

Text Book: C.L.Wadhwa, Engineering Electrical Power Systems, , 6th Edition 2010, New Age International Pub.

Reference Books:
1.Power System Engineering by D.P.Kothari, I.J.Nagrath TMH 2nd edition, 9th reprint 2010.
2.Power System Analysis, N.V.Ramana, PEARSON education, 2010.
3.Power System Analysis, Arthur R. Bergen, Vijay Vittal,2nd Edition, 2009, Pearson Education.

4EE04/ 4EP05 /4EX04 ANALOG AND DIGITAL CIRCUITS

Course Outcomes:

After completing the course, students will be able to

1. Explain the principles of operational amplifiers, parameters of op-amp
2. Illustrate the linear and nonlinear applications of op-amp
3. Demonstrate the knowledge of Voltage regulator and Timer ICs
4. Describe the working of Logic families andtheir applications.
5. Demonstrate the knowledge of combinational and sequential circuits and its application

Unit I:
Introduction to IC's: Operation amplifier; Block schematic internal circuits, Level shifting, overload protection, study of IC 741 op-amp, Measurement of op-amp parameter.

Unit II:
Linear and Non-linear Application of Op-amp: Inverting and non inverting amplifiers, voltage follower, integrator, differentiator differential amplifier, op amp as adder subtractor, op amp as a log and antilog amplifier

Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using op-amps.

Unit III:
Other linear IC's : Block schematic of regulator IC 723, and its applications, study of 78XX, 79XX and its applications, SMPS, Block schematic of timer IC 555 and its applications as a timer, a stable, mono stable, bistable multivibrator and other applications, Operation of phase lock loop system and IC 565 PLL, its application.

Unit IV:
Basic Logic Circuits : Logic gate characteristics, NMOS inverter, propagation delay, NMOS logic gate, CMOS inverter, CMOS logic gates, BJT inverter, TTL, NAND gate, TTL output, state TTL logic families, ECL circuits, composition logic families.

Unit V:
Combinational Digital Circuits: Standard gate assemblies, Binary adder, Arithmetic functions, Digital comparator, Parity check generator, Decoder / demultiplexer, Data selector / multiplexer, Encoder

Unit VI:
Sequential Circuits and Systems: Bistable Latch, Flip-Flop clocked SR,J-K, T, D type shift Registers, counter. Design using filp-flops, Ripple and synchronous types, application of counters

Text Book: Millman, Microelectronics, 2nd Ed., McGraw Hill.

Reference Books:

1. Gayakwad, Op-Amp & LLG, 2nd Ed.
2. Malvino& Leach, Digital Principles & Applications, 4th Ed., McGraw Hill.
3. K.B.Botkar, Integrated Electronics (Khanna Publishers.)

4EE05/4EX05 SIGNALS & SYSTEMS

Course Outcomes:

After completing the course, students will be able to

1. Understand importance and applications of signals and systems
2. Classify Systems into various categories
3. Perform convolution of Analog and Discrete time signals
4. Convert Analog signal into discrete signal by using Sampling Method
5. Apply CTFT,Z-Transform, DTFT, FFT for the analysis of Various Signals and Systems

SECTION-A

Unit-I :
Introduction to Signals and Systems: Signals and Systems, Classification of Signals, Classification of Systems, Some Ideal Signals, Energy and Power Signals, Discretization of Continuous-Time Signals, Analysis of Continuous-Time Systems, Time Domain, Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems.

Unit-II :
Fourier series and Its Properties Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Unit-III :
Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response.

SECTION-B

Unit-IV :
Sampling: Representation of a continuous–Time Signal by its Samples; The Sampling Theorem; Reconstruction of Signals form its Samples using Interpolation; Effect of Under Sampling (Frequency Domain Aliasing); Discrete Time processing of Continuous–Time Signals

Unit-V :
The Z Transform: The Z Transform; The Region of Convergence for the Z- Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot; Properties of Z-Transform; Analysis and Characterization of Discrete-Time LTI Systems using Z-Transform; System Transfer Function; Block Diagram Representation; The Unilateral Z-Transform; Solution of Difference Equation using the Unilateral Z-Transform.

Unit-VI :
Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform

Books Recommended:

1. Signals and systems, Oppenheim and Schafer Prentice Hall India of India 2nd Edition 1997

2. Principles of Linear Systems & Signals, 2E (international version) – Lathi B. P. Oxford University Press

3. Signals &Systems, Smarajit Ghosh, PEARSON education, 2006.

4. Signals And Systems , S. Haykin, 2nd Edition, John Wiley And Sons 1999.

5. Analog And Digital Signal Processing , Ambardar A, 2/3; Thomson Learning-2005.

4EE07/ 4EP06 /4EX0 ELECTRICAL MEASUREMENTS & INSTRUMENTATION - LAB

Minimum Eight experiments based on the syllabus content of 4EE02/4EP02/4EX02Electrical Measurements & Instrumentation. The intensive list of experiment is given below.

1. Measurements of Low resistance by using Kelvin double Bridge.
2. Measurements of Medium resistance by Ammeter Voltmeter method/Wheatstone Bridge
3. Measurement of High resistance by Loss of Charge method.
4. Measurement of Insulation resistance by using Megger
5. Measurement of unknown Inductance using Maxwell Bridge/Hay Bridge/Anderson Bridge
6. Measurement of Unknown Capacitance by Desauty Bridge/Schering Bridge
7. Measurement of frequency using Wien Bridge
8. Extension of range of ammeter using shunt/CT.
9. Extension of range of voltmeter using multiplier/PT.
10. Calibration of Wattmeter by Phantom loading
11. Calibration of energy meter to detect the error in it.
12. Measurement of active & reactive power measurement in 1 phase / 3 phase circuit.
13. Measurement of rotational speed using stroboscope
14. Conversion of non electrical quantity into its equivalent electrical quantity using proper transducer.
15. Compare the accuracy, preciseness, sensitivity of Analog & Digital Measuring Instruments.

4EE08/4EX07 POWER SYSTEMS I - LAB

Minimum Eight experiments based on the syllabus content of 4EE03/4EX03 Power System – I

The intensive list of experiment is given below.

1. To study the performance of a transmission line (using a nominal T and π methods).
2. To calculate A,B,C,D parameters for a transmission line by using nominal T method (either using model or simulation).
3. To calculate A,B,C,D parameters for a transmission line by using nominal π method (either using model or simulation).
4. To study skin effect, proximity effect and Ferranti effect in transmission line.
5. To study Corona phenomenon and corona loss and its control in transmission line.
6. To study conversion of single line diagram to impedance diagram and reactance diagram for a typical power system.
7. To draw the circle diagram for a typical power system.
8. Study of a tap changing transformer (ON and OFF load tap changing).
9. Study of static VAR generator and synchronous condenser.
10. Load flow study for a typical power system (A simulation).
11. To study different types of insulators used in power system.
12. To conduct a dry and wet test on a pin type insulator.
13. To conduct a flashover test on a suspension type insulator.
14. To study a horn gap.
15. To study different types of power cables.
16. To study testing of cables.

Note: One may use models, simulation, numerical, drawing sheets or Experimentation for conducting the above experiments.

4EE09/ 4EP08 /4EX08 ANALOG AND DIGITAL CIRCUIT - LAB

Minimum Eight experiments based on the syllabus content of 4EE04/ 4EP05 /4EX04Analog & Digital Circuit. The intensive list of experiment is given below.

1. To Plot Frequency Response Of Non-Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
2. To Plot Frequency Response Of Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
3. To Perform Op-Amp as Differentiator Using IC741 .
4. Design The Circuit for Supplying 5V,25mA As A Low Voltage Regulator Using IC 723
5. Verification Of Truth Table Of Various Logic Gates Using ICs
6. To Study and Verify The Operation Of SR and MS ,JK Flip Flop
7. To Verify The Operation Of Multiplexer Using IC74153.
8. To Design And Verify Function Of Decade Counterusing IC 7490
9. To Verify The Truth Table Of 4 Bit Comparator

10. To Perform Op-Amp As Integrator Using IC741
11. A stable Multi-vibrator Using IC 555timer
12. To Study And Verify The Operation Of Half-Adder And Full-Adder

4EE10/ 4EP09 /4EX09 ELECTRONIC TECHNOLOGY - LAB

Perform **Minimum Eight** experiments / demonstration based on the following contents and prepare the report as a term work for this laboratory.

- **Study of electronic Components:** Identification of components, name, types, symbol, size, rating and application.
- **Handling Electronic Components:** Finding values and testing (using DMM), test working condition, fault detection.
- **Working with breadboards:** understanding the breadboards for component mounting, working with small circuits on breadboard
- **Soldering:**Soldering skill tips- use of proper soldering Iron, Metal, Flux**,** Cleaning, Tinning etc., mounting components on zero PCB, testing of small circuits mounted on zero PCB. De-soldering of components
- **PCB Layout and design:** Understanding different PCBs, Working on PCB Layout (Software), PCB etching, drilling on PCB, Mounting components on PCB, Working with small circuits on PCB and their testing
- **Electronic circuit Simulation:** Familiarizing with the simulation software, simulation and result validation of simple circuit with software.

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SYLLABUS OF SEM. III & IV B.E. (ELECTRICAL & ELECTRONICS ENGG.)

Semester-III

3EE01/3 EP01/3EX01 ENGINEERING MATHEMATICS -III

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Apply Z Transform to solve of various Linear Difference equations with constant coefficients.
5. Apply the knowledge of vector calculusto solve physical problems.
6. Demonstrate the basic concepts of probability and statistics.

UNIT-I:
(a) **Statistics:**Introduction, Curve fitting by method of least square, change of scale, fitting of straight line and parabola, correlation, regression. Application of statistics to electrical engineering.

(b) **Probability**: Axioms, conditional probability, Bay'stheorem,mathematical expectations, probability distributions:Binomial, Poisson and Normal.Application of probability to electrical engineering.

UNIT-II:
(a)Partial differential equation (PDE)of first order and first degree of following type-

(i) f (p, q) = 0; (ii) f (p, q, z) =0; (iii) f (p, q, x, y) = 0; (iv) Pp + Qq =R (Lagrange's Form); (v) Clairaut form Z = px + qy + f(p, q) . Applications of PDE to electrical circuits.

(b)DifferenceEquation: -Solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.Applications of difference equations to electrical engineering.

UNIT-III:
Laplace Transforms: Definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Laplace transform of Periodic Function, Impulse Function, Unit Step Function. Solution of linear differential equation using Laplace transform.

UNIT-IV:
Fourier Transforms- Definition, standard forms, properties of Fourier transform,inverse Fourier transform, Fourier Transform of some basic functions.Fourier transform of Periodic Function, Impulse Function, Unit Step Function.Fourier cosine transforms. Applications of Fourier Transforms in electrical engineering.

UNIT-V:
Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z-transforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms.

UNIT-VI: Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, Line Integral, Stokes and Divergence Theorem. Application of Vector calculus to electromagnetics.

Text Book: Elements of Applied Mathematics by P.N.Wartikar and J.N.Wartikar.

Reference Books:
1. Statistical Methods by S.G. Gupta
2. Advance Engineering Mathematics by B.S.Grewal
3. Integral Transforms by Goyal & Gupta.

3EE02/3 EP02/3EX02 ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes:

After completing this course studentwill be able to:

1. Analyze electric and magnetic circuits using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Unit I:
a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources., Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input, generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:
Network Theorems: Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :
Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:
a] **Transformation of a Circuit into s-domain:** LaplaceTransformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution ofLinear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :
Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :
Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.
2. Circuit and Network Analysis, SudhakarShyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.

3EE03/3 EP03/3EX03 -ELECTRICAL MACHINE - I

Course Outcomes:

After Completing this course, students will be able to:

1. Explain the construction and working of DC Machines.
2. Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generators.
3. Demonstrate the various characteristics, starting, speed control and braking operation on DC motors
4. Analyze the performance of DC machines by conducting the various tests on it.
5. Determine the parameters of equivalent circuits, performance parameters of single phase transformer and merits & demerits of autotransformer
6. Explain the construction, working, different connections, applications and testing of three phase transformer.

Unit I
D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II
D.C. Generators: Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D. C. Generators as per Indian standard.

Unit III
D.C. Motors: Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.

Unit IV
Single phase Transformer: Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard.
Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V : Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.

Unit VI :
Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

Text Book: Electrical Machines by D P Kothari & I J Nagrath, Tata McGraw-Hill , New Delhi.

Reference Books:

1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)
2) H. Cotton: Advance Electrical Technology, (Wheeler publication)
3) Indian Standard Guide for testing DC Machine. IS: 9320-1979, (Indian Standards Institution, New Delhi.)
4) Indian Standard Specification for safety transformer. IS: 1416-1972, (Indian Standards Institution, New Delhi.)

3EX04 ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes:
After successfully completingthecourse, thestudents will be ableto

1. Demonstrate the knowledge of semiconductor physics and PN Junction Diode
2. Analyze the rectifier and regulator circuits.
3. Analyze the operational parameters of BJT
4. Analyze various multistage amplifier circuits
5. Demonstrate the knowledge of JFET, MOSFET, UJT and their operational parameters

UNIT-I:
P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current , drift current, mobility and resistivity, generation and recombination of carriers, PN junction diode , zener diode, zener diode as voltage regulator, Numericals based on voltage regulator (line and load regulation, Numericals based on resistivity, conductivity, mass action law)

UNIT-II: Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, clipping and clamping, Numericals based on clipping and clamping

UNIT-III:
Theory and Analysis of Bipolar Junction transistor, 'H' Parameter, methods of biasing, their needs, 'Q' and stability factors, compensation techniques.

UNIT-IV
Study of typical transistor amplifier circuits i) Emitter follower, ii) Darlington emitter follower. iii) Bootstrap emitter follower, iv) RC coupled amplifier, v) Transformer coupled amplifier, vi) Cascaded amplifier, vii) Direct coupled amplifier, viii) Cascade stage.

UNIT-V :
FETs (JFET & MOSFET): Types, Characteristics and parameters (u, gm &Rds), Applications of FET amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

UNIT-VI :
Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

Text Book:
Millman's Electronic Devices & Circuits by J.Millman, C.Halkias, Satyabrata Jit TMH 3rd ed, 2nd reprint 2011

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.

3EX05 ELECTRONIC COMMUNICATION THEORY

Course Outcomes:
After successfully completing the course, the students will be able to

- Understand different types of communication noise
- Perform the signal analysis and transformation
- Understand the concept of wave propagation and RF transmission lines
- get acquaint with basic Antenna Theory

SECTION-A

Unit I: Signal and Noise : Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & non periodic, Frequency response, bandwidth, bandwidth requirement for different types of signals such as telephone speech, music and video. External and Internal noise, signal to noise ratio, noise figure, noise factor measurement, equivalent noise Temperature.

Unit II: Signal Analysis : Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.

Unit III: Probability and Random Signal Theory: Probability, Random variable, PDF Random processes, stationarity, Mean, Correlation and Covariance Functions.

SECTION-B

Unit IV: Wave Propagation : Electromagnetic waves, Ground waves, Sky waves, ground waves, space waves, Ionosphere, critical frequency, maximum usable frequency, virtual height, skip distance, LOS communication, fading.

Unit V: RF Transmission Lines : Parallel and coaxial transmission line, equivalent circuit of transmission line, standing wave, characteristic(shunt) impedance, quarter wave and half wave length transform.

Unit VI: Antenna Basics & Types of Antenna : Principle of radiation, antenna power gain, beam width, polarization, bandwidth and radiation resistance, Isotropic radiator, Resonant antenna: Half wave, Folded dipole antenna, Non resonant antenna, antenna arrays, parasitic reflector, parasitic director, design of yagi-uda antenna (up to 5 elements) Long, wire, helical, rhombic, discone, log periodic, loop antenna, low, medium and high frequency antenna.

Text Books:

(1) Kennedy G.: “Electronic Communication System” Tata Mc-Graw Hill Co., NewDelhi (Third Edition)
(2) SimonHaykin : Communication System, John Wiley, Eastern Ltd., New York, (Third Edition), 1994.

Reference Books :

(1) CollinsDennis,Collins John “Electronic Communications” (PHI)
(2) B. P. Lathi : “ Modern Digital and Analog Communication systems” 3rd Edition, Oxford Uni. Press, New Delhi.
(3) Taub and Schilling D.L. : Principles of Communication Systems, McHill Co, Tokyo, 1994 (2/e.)

3EE06/3 EP06/3EX06 ELECTRICAL CIRCUIT ANALYSIS LAB

Minimum eight experiments based on the syllabus content of 3EE02/3 EP02/3EX02Electrical Circuit Analysis. The intensive list of experiment is given below.

1. Verification of output response of series R-C circuit for step input
2. Study of dot convention and determination of
   A) Mutual inductance
   B) Coupling coefficient of b transformer
3. Verification of Mesh and Node analysis.
4. Verification of Superposition theorem.
5. Verification of Thevenin’s theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of reciprocity theorem.
8. Study of Milliman’s theorem& verification.
9. Verification of Norton’s theorem.
10. Determination of ABCD parametersT-network &Π-network.
11. Study of Tie set and Cut set schedule for a given network.
12. MATLAB simulation for o/p verification of any theorem.
13. Determination of Z and Yparameter.
14. Determination of hybrid parameter.

3EE07/3 EP07/3EX07 ELECTRICAL MACHINES - I LAB

Minimum eight experiments based on the syllabus content of 3EX03Electrical Machines – I.

The indicative list of experiments is given below.

1. Plot the OCC of DC generator and find its critical resistance and critical speed.
2. To study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.
5. Speed Control of DC Shunt motor by armature control & Field Control method.

6. Perform the direct load test on DC series/shunt/compound motor to plot its performance characteristics, and determine its efficiency and speed regulation.
7. Conduct the Swinburn's test on DC machine to estimate its performance at any desired load condition.
8. Conduct the Hopkinson's test on DC Machine to analyze its performance.
9. Perform Electric Braking Operation on DC shunt Motor.
10. Conduct the Polarity test and Ratio test on transformer
11. Calculate the Equivalent circuit parameters of single-phase transformer by performing OC & SC test on itand determine its efficiency and voltage regulation.
12. Perform the direct load test on single phase/three phase transformer and determine its efficiency and voltage regulation.
13. Conduct back to back test (Sumpner's test)on two single phase transformers and determine the temperature rise.
14. Conduct the magnetic balance test on three phase transformer.
15. Conduct the vector group test on three phase transformer.
16. Conversion of three phase to two phase supply system using Scott Connection
17. Capture the waveform of inrush current of single phase/three phase transformer using DSO.

Reference:

S.G.Tarnekar, P.K.Kharbanda, S.B.Bodkhe, S.D.Naik and D.J.Dahigaonkar"Laboratory Courses in Electrical Engineering", S. Chand & Co. New Delhi, 2013.

3EE08/3 EP08/3EX08 ELECTRONIC DEVICES & CIRCUITS LAB

Minimum eight experiments based on the syllabus content of 3EE05/3 EP05/3EX04 Electronic Devices & Circuits. The intensive list of experiment is given below.

1. To study and verify V-I characteristics of semiconductor diode
2. To study and verify V-I characteristics of Zener diode.
3. To verify the performance of half wave rectifier circuit with and without filter.
4. To verify the performance of full wave bridge rectifier circuit and determination of load regulation.
5. To verify the performance of Zener voltage regulator.
6. To verify characteristics of bipolar junction transistor
7. To study and perform C-E amplifier gain with variation of load resistance.
8. To study and verify the characteristics of FET
9. To study UJT as a relaxation oscillator
10. To study phase shift oscillator & determine frequency of oscillation
11. To study characteristics of MOSFT
12. To study clipper circuits using diodes
13. To study clamper circuits using diodes
14. To study and verify operation of cascade amplifiers
15. To verify operation of transistor as a switch

3EE09/3 EP09/3EX09 ELECTRICAL TECHNOLOGY LAB

Perform minimum Eight practicals / demonstration from the following list and prepare the report as a term work for this laboratory.

1. Introduction to standard symbols used in wiring diagrams
2. Introduction to different wiring accessories.
3. Demonstration of different types of wirings eg. Domestic wiring, commercial wiring, Industrial wiring.
4. Connection of Staircase wiring, Godown wiring, fluorescent lamp. Ceiling fan, air cooler etc
5. Domestic wiring diagrams
6. Connections of switch board, MCB and energy meter
7. Testing and electrical Maintenance of domestic appliances like lamps, electric iron, heater, geyser, air cooler, fan, microwave-oven, induction heater, etc.
8. Insulation resistance and earth resistance measurement
9. Conduct the load survey for domestic/commercial /Industrial consumers
10. Illumination system Design (selection of type and number of lamps required for any location)
11. Calculation of Energy bill for LT & HT consumers.
12. Safety precautions while working with electrical system
13. Demonstration of first aid treatment after getting electric shock.
14. Study of various components of solar power plant.
15. Design calculation of small capacity roof top solar power plant

SEMESTER – IV

4EE01/4EP01/4EX01 ELECTROMAGNETIC FIELDS

Course outcomes :

At the end of the course the student should be able to:

1. Demonstrate the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field.
4. Apply Maxwell's equation in different forms (differential and integral) to diverse engineering problems.

Unit I : Review of Vector Analysis: Cartesian, cylindrical and spherical co-ordinate systems, vector algebra and vector calculus. Line integral and multiple integrals. Gauss theorem.

Unit II : Electrostatics: Coulomb's law, electric field, Gauss flux theorem in integral and differential form. Electrostatics potential, Poison and Laplace equations.

Unit III : Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

Unit IV : Magnetic fields: Biot-Savart law, Ampere's law in integral and differential form. Continuity equation, time of relaxation. Vector and Scalar magnetic potential, electric current, J vector..

Unit V : Magnetic fields in materials: magnetic dipole equivalent volume and plane section curve. H vector, magnetization vector M, boundary conditions between magnetic materials, inductance, Electromagnetic Energy.

Unit VI : Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

Books Recommended:

Text Book: Engineering Electro- magnetics by Hayt W.H. Tata Mc-Graw Hill publication

Reference Books:

1. Electromagnetic fields by TVS Arun Murthy S Chand & Co
2. Principles and applications of Electromagnetic fields by Plansycollin , Mc-Graw Hill Books Co.
3. Foundations of electromagnetic theory by John Reitz, Addison Wesley Pub Co.
4. Basic electromagnetic field by Herbert Neelf, Harber International education
5. Introduction to electromagnetic, Derucy and Johnson, Mc-Graw Hill Books Co.

4EE02/4EP02/4EX02 ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Course Outcomes:

A student completing this course, should be able to:

1. Classify the various measuring instruments like PMMC, MI, Electrodynamometer, and Induction type instruments for measurement of current, voltage, power, and energy.
2. Demonstrate the construction & working of Instrument Transformers/special purpose meters.
3. Analyze various methods for measurement of resistance, inductance, capacitance using bridges.
4. Explain the working of various Digital measuring instruments.
5. Explain the generalized Instrumentation system & working of different transducers used for measurement of various non electrical quantities.

Unit-I :
Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Analog Ammeter, Voltmeter, Electrodynamic type Construction, ,theory of operation, torque equation, errors, merits and demerits of each type.

Unit II : Wattmeter and Energy meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type. Analysis of three phase balanced load:- Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III :

Instrument transformers- C.T.and P.T., Importance, theory and construction, phasor diagram, causes of errors, testing, and applications.

Special Instruments- Frequency meter, Power factor meter, Phase sequence indicator, Synchroscopeand Stroboscope.

Unit IV:
Measurement of circuit parameters- Different methods of measurement of low, medium, high value of resistance, sensitivity and accuracy of different methods. AC and DC bridges, Wheat -stone, Kelvin, Maxwell , Wein , Hay , De-Sauty ,Schering , Owen , Anderson's bridge

Unit V:
Digital methods of measurements,Introduction to A/D, D/A techniques , F/V and V/F conversion techniques , Digital voltmeter (DVM), ammeter, wattmeter, multimeter and Electronic energy meter, Sources of error, Inherent error in digital meters

Unit VI:
Generalized Instrumentation system- characteristics of measurement and Instrumentation system. Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Force and torque transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers. Elastic-members (Bellows, Bourdon tube, Diaphragm)

Text Book: A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpat Rai& Co (P) Ltd.

Reference Books:

1. E.W.Golding&F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler& Co.
2. Albert D. Helfrick& William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, .
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education.
4. Bouwens, A.J., "Digital Instrumentation", McGraw Hill.

. **4EE03/4EX03 POWER SYSTEM - I**

Course Outcomes:

At the end of the course the student should be able to:

1. Calculate the transmission line parameters like resistance, inductances and capacitances.
2. Explain the various configurations of line conductors and their effects on the line parameters.
3. Estimate the electrical characteristics of transmission lines and hence to evaluate the performance of the lines.
4. Draw the single line diagram of any electrical system.
5. Perform the per unit calculation of any electrical system.
6. Apply knowledge of voltage control and power factor improve methods practically.
7. Perform the load flow or power flow methods to any electrical system.
8. Design HV, EHV lines, insulators used.
9. Evaluate the mechanical parameters of line supports.
10. draw the various underground cable configurations and to calculate their electrical parameters.

Unit I :
Transmission line parameters: Calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on capacitance, interference with communication lines.

Unit II :
Electrical characteristics of transmission line : V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal Π and nominal T representations, Ferranti effect, corona phenomenon, effect of corona. Representation of power systems: per unit system and one-line reactance diagrams

Unit III :
Voltage control and power factor improvement: Receiving and sending end power circle diagrams, methods of voltage control and power factor improvement, use of static VAR generators and synchronous phase modifiers.

Unit IV : Load flow studies: Load flow problem, classification of buses, network modelling, Y-bus matrix, load flow equation, Gauss-Seidel and Newton-Raphson methods, and comparison of these methods.

Unit V :

Mechanical design: Materials used, types of insulators, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Line supports for LV, HV and EHV, sag calculation.

Unit VI :

Underground cables: Material used for conductor & insulation, different types of cables and their manufacture, parameters of underground cable, grading of cable.

Text Book: C.L.WadhwaEngineering Electrical Power Systems, , 6th Edition 2010, New Age International Pub.

Reference Books:

1.Power System Engineering by D.P.Kothari, I.J.Nagrath TMH 2nd edition, 9th reprint 2010
2.Power System Analysis, N.V.Ramana, PEARSON education, 2010.
3.Power System Analysis, Arthur R. Bergen, Vijay Vittal,2nd Edition, 2009, Pearson Education.

4EE04/ 4EP05 /4EX04 ANALOG AND DIGITAL CIRCUITS

Course Outcomes:

After completing the course, students will be able to

1. Explain the principles of operational amplifiers, parameters of op-amp
2. Illustrate the linear and nonlinear applications of op-amp
3. Demonstrate the knowledge of Voltage regulator and Timer ICs
4. Describe the working of Logic families andtheir applications.
5. Demonstrate the knowledge of combinational and sequential circuits and its application

Unit I:

Introduction to IC's: Operation amplifier; Block schematic internal circuits, Level shifting, overload protection, study of IC 741 op-amp, Measurement of op-amp parameter.

Unit II:

Linear and Non-linear Application of Op-amp: Inverting and non inverting amplifiers, voltage follower, integrator, differentiator differential amplifier, op amp as adder subtractor, op amp as a log and antilog amplifier

Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using op-amps.

Unit III:

Other linear IC's : Block schematic of regulator IC 723, and its applications, study of 78XX, 79XX and its applications, SMPS, Block schematic of timer IC 555 and its applications as a timer, a stable, mono stable, bistable multivibrator and other applications, Operation of phase lock loop system and IC 565 PLL, its application.

Unit IV:

Basic Logic Circuits : Logic gate characteristics, NMOS inverter, propagation delay, NMOS logic gate, CMOS inverter, CMOS logic gates, BJT inverter, TTL, NAND gate, TTL output, state TTL logic families, ECL circuits, composition logic families.

Unit V:

Combinational Digital Circuits: Standard gate assemblies, Binary adder, Arithmetic functions, Digital comparator, Parity check generator, Decoder / demultiplexer, Data selector / multiplexer, Encoder

Unit VI:

Sequential Circuits and Systems: Bistable Latch, Flip-Flop clocked SR,J-K, T, D type shift Registers, counter. Design using filp-flops, Ripple and synchronous types, application of counters

Text Book: Millman, Microelectronics, 2nd Ed., McGraw Hill.

Reference Books:

1. Gayakwad, Op-Amp & LLG, 2nd Ed.
4. Malvino& Leach, Digital Principles & Applications, 4th Ed., McGraw Hill.
5. K.B.Botkar, Integrated Electronics (Khanna Publishers.)

4EE05/4EX05 SIGNALS & SYSTEMS

Course Outcomes:
After completing the course, students will be able to

1. Understand importance and applications of signals and systems
2. Classify Systems into various categories
3. Perform convolution of Analog and Discrete time signals
4. Convert Analog signal into discrete signal by using Sampling Method
5. Apply CTFT,Z-Transform, DTFT, FFT for the analysis of Various Signals and Systems.

Unit-I :
Introduction to Signals and Systems: Signals and Systems, Classification of Signals, Classification of Systems, Some Ideal Signals, Energy and Power Signals, Discretization of Continuous-Time Signals, Analysis of Continuous-Time Systems, Time Domain, Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems.

Unit-II :
Fourier series and Its Properties Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Unit-III :
Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response.

Unit-IV :
Sampling: Representation of a continuous–Time Signal by its Samples; The Sampling Theorem; Reconstruction of Signals form its Samples using Interpolation; Effect of Under Sampling (Frequency Domain Aliasing); Discrete Time processing of Continuous–Time Signals

Unit-V :
The Z Transform: The Z Transform; The Region of Convergence for the Z- Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot; Properties of Z-Transform; Analysis and Characterization of Discrete-Time LTI Systems using Z-Transform; System Transfer Function; Block Diagram Representation; The Unilateral Z-Transform; Solution of Difference Equation using the Unilateral Z-Transform.

Unit-VI :
Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform

Text Book: Signals and systems, Oppenheim and Schafer PHI. 2nd Edition 1997

Reference Books:

1. Signals &Syatems, Smarajit Ghosh, PEARSON education, 2006
2. Signals And Systems , S.Haykin, 2nd Edition, John Wiley And Sons 1999
3. Analog And Digital Signal Processing , Ambardar A, 2/3; Thomson Learning-2005

4EX06 ELECTRICAL MEASUREMENTS & INSTRUMENTATION- LAB

Minimum eight experiments based on the syllabus content of 4EE02/4EP02/4EX02Electrical Measurements & Instrumentation. The intensive list of experiment is given below.

1. Measurements of Low resistance by using Kelvin double Bridge.
2. Measurements of Medium resistance by Ammeter Voltmeter method/Wheatstone Bridge

3. Measurement of High resistance by Loss of Charge method.
4. Measurement of Insulation resistance by using Megger
5. Measurement of unknown Inductance using Maxwell Bridge/Hay Bridge/Anderson Bridge
6. Measurement of Unknown Capacitance by Desauty Bridge/Schering Bridge
7. Measurement of frequency using Wien Bridge
8. Extension of range of ammeter using shunt/CT.
9. Extension of range of voltmeter using multiplier/PT.
10. Calibration of Wattmeter by Phantom loading
11. Calibration of energy meter to detect the error in it.
12. Measurement of active & reactive power measurement in 1 phase / 3 phase circuit.
13. Measurement of rotational speed using stroboscope
14. Conversion of non electrical quantity into its equivalent electrical quantity using proper transducer.
15. Compare the accuracy, preciseness, sensitivity of Analog & Digital Measuring Instruments.

4EX07 POWER SYSTEMS I LAB

Minimum eight experiments based on the syllabus content of 4EE03/4EX03 Power System - I

The intensive list of experiment is given below.

1. To study the performance of a transmission line (using a nominal T and π methods).
2. To calculate A,B,C,D parameters for a transmission line by using nominal T method (either using model or simulation).
3. To calculate A,B,C,D parameters for a transmission line by using nominal π method (either using model or simulation).
4. To study skin effect, proximity effect and Ferranti effect in transmission line.
5. To study Corona phenomenon and corona loss and its control in transmission line.
6. To study conversion of single line diagram to impedance diagram and reactance diagram for a typical power system.
7. To draw the circle diagram for a typical power system.
8. Study of a tap changing transformer (ON and OFF load tap changing).
9. Study of static VAR generator and synchronous condenser.
10. Load flow study for a typical power system (A simulation).
11. To study different types of insulators used in power system.
12. To conduct a dry and wet test on a pin type insulator.
13. To conduct a flashover test on a suspension type insulator.
14. To study a horn gap.
15. To study different types of power cables.
16. To study testing of cables.

Note: One may use models, simulation, numerical, drawing sheets or Experimentation for conducting the above experiments.

4EX08 ANALOG AND DIGITAL CIRCUIT LAB

Minimum eight experiments based on the syllabus content of 4EE04/ 4EP05 /4EX04Analog & Digital Circuit. The intensive list of experiment is given below.

1. To Plot Frequency Response Of Non-Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
2. To Plot Frequency Response Of Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
3. To Perform Op-Amp as Differentiator Using IC741 .
4. Design The Circuit for Supplying 5V,25mA As A Low Voltage Regulator Using IC 723
5. Verification Of Truth Table Of Various Logic Gates Using ICs
6. To Study and Verify The Operation Of SR and MS ,JK Flip Flop
7. To Verify The Operation Of Multiplexer Using IC74153.
8. To Design And Verify Function Of Decade Counterusing IC 7490
9. To Verify The Truth Table Of 4 Bit Comparator
10. To Perform Op-Amp As Integrator Using IC741
11. A stable Multi-vibrator Using IC 555timer
12. To Study And Verify The Operation Of Half-Adder And Full-Adder

4EX09 ELECTRONIC TECHNOLOGY LAB

Perform Minimum Eight experiments / demonstration based on the following contentand prepare the report as a term work for this laboratory.

- **Study of electronic Components:** Identification of components, name, types, symbol, size, rating and application.
- **Handling Electronic Components:** Finding values and testing (using DMM), test working condition, fault detection.
- **Working with breadboards:** understanding the breadboards for component mounting, working with small circuits on breadboard
- **Soldering:**Soldering skill tips- use of proper soldering Iron, Metal, Flux, Cleaning, Tinning etc., mounting components on zero PCB, testing of small circuits mounted on zero PCB. De-soldering of components
- **PCB Layout and design:** Understanding different PCBs, Working on PCB Layout (Software), PCB etching, drilling on PCB, Mounting components on PCB, Working with small circuits on PCB and their testing
- **Electronic circuit Simulation:** Familiarizing with the simulation software, simulation and result validation of simple circuit with software.

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NOTIFICATION

No. 90 /2020 Date : 26/10//2020

Subject : Implementation of new Syllabi of Semester III & IV B.E. (Chemical) / B. Text. E./ B.Tech. (Chem.) (Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum …

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester III & IV of of B.E.(Chemical)/B.Text.E./B.Tech. (Chem.) (Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2020-21 & onwards as per **"Appendix-A"** as given :

Sd/-
(Dr.T.R.Deshmukh)
Registrar

"Appendix – A"

SYLLABUS OF B.TEXT. ENGG. SEM. III & IV C.B.C.S.]

3 TX 01 Textile Fibre -I

Course objectives :

1) To gain basic knowledge about essential and desirable properties of textile fibres and their classification.
2) To gain the knowledge about various textile natural fibres.
3) To understand various methods for analyzing fibre structure.

Course outcomes :

After the completion of Textile Fibre –I course, students will able to demonstrate,

1) the essential and desirable properties of Textile fibre and their classification
2) the physical, chemical and biological properties of cotton fibre
3) the physical, chemical and biological properties of jute and flax
4) the physical, chemical and biological properties of wool
5) the physical, chemical and biological properties of Silk
6) the various methods for analyzing fibre structure

SECTION-A

Unit-I: Definition of fibre, Classification of Textile fibres, Essential and desirable properties of Textile fibres, Polymers: Definition, Types of polymers, Requirements of fibre forming polymers. Basic structure of fibre: Concept of molecular weight, Degree of polymerization, Orientation and crystallinity, effect of orientation and crystallinity on the properties of fibres.

Unit-II: Cotton: Introduction, structure of Cotton fibre, fibre morphology, cotton polymer system, Physical, chemical and biological properties, Applications. Introduction to Banana, Pineapple fibres and their distinctive features and applications.

Unit-III: Jute: Cultivation and Extraction of Jute fibre, Structure of jute fibre, physical, chemical and biological properties, Applications. Flax: Retting and extraction process, structure of flax fibre, physical, chemical and biological properties, Applications. Introduction to hemp, ramie fibres and their distinctive features and applications.

SECTION-B

Unit-IV: Wool: Types of wool, grading of wool, Structure of wool, chemical composition, polymer system of wool, Physical, chemical and biological properties, Applications. Introduction to fibres like, mohair, camel, alpaca and their distinctive features and applications.

Unit-V: Silk: Types of silk, Production of silk (life cycle, reeling), Structure of silk, chemical composition, polymer system of silk, Physical, chemical and biological properties, Applications, blending opportunities in silk.

Unit-VI: Analysis of fibre structure: Introduction, crystal structure, and polymer crystals. i) X-ray diffraction: Bragg's law, X-ray diffractometer. ii) Electron microscopy: Principle and working of Transmission and scanning electron microscope. iii) Spectroscopy: Principle and working of IR-Spectroscopy and NMR-Spectroscopy. Introduction to thermal analysis of polymers.

Text Books :

1. Textile Fibres – Vol.-I by V.A.Shenai
2. Fibre Science and Technology by S.P. Mishra.

Reference Books :

1. Textile Fibres by H.V.S. Murthy
2. Textile Science- Gohl and Vilensky
3. Hand book of Textile Fibres Vol. I & II by Gordon & Cook.
4. Polymer science- V. Gowarikar
5. Investigation of Physical Properties of textile fibres- Hearle & Meredith.

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3TX02 YARN MANUFACTURING - I

Course Objectives:

1. To gain basic knowledge about various preparatory spinning processes, viz blowroom, carding, drawing and combing.

2. To gain the knowledge about modern aspects of various preparatory spinning processes viz blow room, carding, drawing and combing.

3. To understand various parameters influencing performance ofpreparatory spinning processes.

Course Outcomes:

After the completion of yarn manufacturing course, students will able to -

1. Explain about the concept of ginning and blowroom process and description regarding ginning machines and basics of opening and cleaning.
2. Explain about the concept of blowroom process and description regarding blowroom machines.
3. Explain about the concept of carding process and description about carding machines.
4. Explain about the concept of drawing process and description about drawframe machines.
5. Explain about the concept of combing preparatory and combing process and description regarding combing preparatory machines and basics of combing process.
6. Explain about the concept of combing process and description regarding combing machines.

SECTION-A

Unit-I Ginning: Objectives, classification, different ginning machines, machine parameters, ginning performance. Baling and pressing–objectives, baling and pressing machines, bale specifications and recent developments in ginning machine.

Blowroom: Basics of opening and cleaning, historical review of conventional blowroom machines, degree of opening and cleaning, opening intensity and cleaning efficiency, process flow chart of spinning process.

Unit-II Modern blowroom: Introduction, objectives, its features, modern opening and cleaning machines-automatic bale openers, pre-cleaners, fine openers, fine cleaners, multi roll technology, multi-function separators. Chute feed system, automatic waste collection system. Production and cleaning efficiency calculations.

Mixing-objectives, need of mixing, modern mixing machines. Blending-objectives, selection of blend constituents, blending techniques, modern blending machines, compatibility requirements, blend irregularity.

Unit-III Carding: Objectives, modern carding machines, features of new generation cards, operating regions, selection of card clothing, transfer efficiency-definition, importance, factors affecting transfer efficiency, autolevellers-basic principle, types, working, different settings of card, production and cleaning efficiency calculations, recent developments in carding machine-on line nep control, auto can changer, automatic suction system, sliver information system etc.

SECTION -B

Unit-IV Drawing: Objectives, principle of drafting, modern drawframe machine, types of drafting system, types of draft, roller setting, rollers slip and drafting waves. Autolevellers- principle, types, working, process parameters affecting drawing performance. Production and draft calculations. Recent developments in drawframe machine.

Unit-V Combing preparatory: Objectives, importance, parameters of comber lap, methods of comber lap preparation, different sequences of combing preparatory machines. Process parameters, production calculations and recent developments in combing preparatory machines.

Combing: Objectives, basics of combing process and combing operation

Unit-VI Combing: Modern comber, combing cycle, timing diagram, settings and its importance, fractionating efficiency. Forward and backward feed. Comber noil, influence of combing operation on sliver quality. Automation in comber-automatic noil collection, automatic material handling. Production calculations and technical specifications of modern comber machine.

Text Books :

1. 'Manual of Textile Technology', by Klein W, Vol. I – III.
2. 'Spun Yarn Technology', by Oxtoby E.
3. 'Fundamental of Spun Yarn Technology,' by Lawrence C A.
4. 'Handbook of Yarn Production', by Lord P R.

Reference Books :

1. Manual of Cotton Spinning Vol. II, Part-I by P. Lord.
2. Manual of Cotton Spinning Vol. II, Part-II by Shirley.
3. Opening Cleaning and Picking by Dr. Zoltan S. Szaloki,
4. Cotton Ginning, Textile Progress, The Textile Institute Publication.
5. Blow room and Carding- Training Program conducted by NCUTE, IIT, Delhi.
6. Essential calculations of practical cotton spinning by T.K. Pattabhiraman.
7. Elements of Blowroom and Carding by Dr. A. R. Khare.

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3TX03 FABRIC MANUFACTURING – I

Course objectives :

1) To gain basic knowledge about various weaving preparatory processes viz. winding, warping sizing.
2) To gain the knowledge about modern aspects various weaving preparatory process viz. winding, warping sizing.
3) To understand various key parameters of influencing performance of weaving preparatory process viz. winding, warping sizing.

Course Outcomes :

After the completion of Fabric Manufacturing –I course, students will able to demonstrate

1) Knowledge about the concept of winding process and description regarding high speed winding machines.
2) Knowledge about the automatic winding machines
3) Knowledge about the concept of warping process and description about high speed warping machines
4) Knowledge about the automatic warping machines
5) Knowledge about the concept of sizing process & description about sizing machines
6) Knowledge about control systems, ingredients, and cooling elements related to sizing process.

Section A

Unit I: Brief outline of the process involve in weaving, Yarn quality attributes, Uster yarn quality, objectionable faults & its classification as per Uster calssimate. Winding: Objectives:- High speed winding process, geometrical aspects of winding machines, description about tensioners, slub catchers, winding unit, anti-patterning and safety devices. Concept of cone angle, angle of wind, wind per traverse, production efficiency speed, time, calculation related to winding process.

UNIT II: Automatic cone and cheese winding machines, methods of yarn joining, splicing and knotting. Concept of P& Q winding and their applications, construction details of automatic winding machines:- Creel, unwinding tension regulation unit, splicer, EYC, automatic package doffing clearing and dust removal Splicing: - Types viz. mechanical, pneumatic, aqua and thermal. Splice quality assessment. EYC: - optical and capacitance

UNIT III: Internal and between machine material flow with respect to winding, brief description about pirn winding process. Warping: - Objectives and classification of warping process, construction details about beam warping: viz. Creel, tensioner, stop motions and head stock drive. Modern developments in warping: - Designing creels, various modern types of creel, pre tensioner, automatic tension regulation system

Section B

UNIT IV: Modern developments with respect to head stock of beam warping. Auto leasing, drive, breaks and doffing and donning systems. Sectional warping: - objective, constructional details of sectional warping process, auto-leasing, drum traverse, cone angle adjustment and beam traverse. Calculation related to production, speed, time, efficiency of warping machines

UNIT V: Concept of yarn weaveability. Sizing :- Necessity and objectives, constructional details and calculations regarding slasher sizing and multi-cylinder sizing. Study of modern sizing elements viz. creels, unwinding tension control, saw box, yarn drying methods, head stock weavers beam pressing and doffing.

Unit VI: Sizing control systems viz. size paste level, temperature, stretch, moisture control, driving arrangement of sizing machines, crawl speed, production calculation speed, time, and efficiency. Concept of optimum size pick up and add-on different sizing ingredients with respect to properties, cooking methods and there testing. Description about size paste cooking plants, types of sizing: Heavy, medium, light and pure. Sizing of polyester, PV, PC, blends.

Text Books:

1. Yarn Preparation (Vol-1 and 2) By R.Sengupta.
2. Sizing Method, Material and Mechanism By D.B.Ajgaokar Andtalukdar.

Reference Books:

1. 'Weaving Calcutions', By R. Sengupta
2. 'Textile Mathematics (Vol-3)', By J.E.Booth
3. 'Weaving Technology And Operation', By Allan Armored Andwalter S Sondhelm.
4. 'Weaving Technology', By N.M.Kulkarni
5. 'Weaving Machine : Mechanism And Material', By M.K.Talukdar.

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3TX04 Textile Testing- I

Course objectives:

1) To gain basic knowledge about various statistical techniques used in textile testing field
2) To learn various testing methodologies used in the evaluation of fibre characteristics.
3) To understand the evaluation of basic yarn properties

Course outcomes:

After the completion of Textile Testing –I course, students will able to

1) Demonstrate knowledge of statistic applications in Textile testing field
2) Demonstrate the statistical analysis of various testing results
3) Explain the various sampling methods and moisture properties of textile
4) Demonstrate knowledge of measurement of various types of fibre parameters
5) Explain about various count of yarn and there measurement
6) Explain the evaluation of tensile properties and evenness of yarn

SECTION A

Unit- I: Introduction to textile testing, Tested quality schemes,

Element of Statistics: Graphical presentation of Data, Measures of Location like Mean, Mode, Median, Quartiles, Percentiles. Measures of Dispersion: Range, Quartile Deviation, Percentage Mean Deviation, Standard Deviation, Coefficient of Variation %, Variance. Comparison of frequency distribution

Unit -II : Population values and sample values, estimation of population characteristics from samples and the use of confidence intervals; determination of number of tests to be carried out to give chosen degree of accuracy; test of significance of means and variance, quality control charts, selection of samples for testing; random and biased samples,

Unit -III: Different types of sampling methods of textile materials, sampling for raw cotton testing. selection of sample for testing, fibre sampling from combed slivers, roving and yarns, yarn sampling, fabric sampling. Moisture regain, moisture content and RH %, effect of regain on fibre properties

Testing of Fibre properties - Historical review of fibre length and strength testing: fibre sorter, analysis of sorter diagram, Stelometer.

SECTION B

Unit IV: Fibre fineness: Airflow principle, Micronaire testers. Maturity: Maturity ratio, Maturity Coefficient – testing methods of maturity, Shirley trash analyzer. Advance Fibre Testing: High Volume Instruments (HVI): length, strength, maturity, trash and color modules. Advanced Fibre Information System (AFIS): length, nep and trash modules, Introduction to Instron testing.

Unit V: Yarn Dimension: Count, Direct and Indirect yarn numbering , Count conversion , Measurement of count: Spun and plied yarns. Measurement of Yarn diameter

Twist: Helical geometry, Twist angle, Effect of twist on yarn and fabric properties, measurement of twist by different methods.

Unit VI: Tensile Testing : Terminology and definitions load elongation curves, stress strain curve, initial young modulus, yield point, work of rupture, work factor, elastic recovery, instantaneous and time dependent effects, creep, Types of tensile testing machines: CRL, CRE and CRT principle, various types of measuring instruments and their working principles, factors affecting tensile properties. Evenness: Principle of measurement, Periodic Variation and Spectrogram. Electronic capacitance tester, Causes and effect of Irregularity.

Reference Books:

1) Principles of Textile Testing -J.E. Booth
2) Physical Testing of Textiles - B.P.Saville
3) Textile Testing - Grover and Hamby.
4) Handbook of Technical Textiles:- Anand and Harrocks.
5) Testing and Quality Management- V. K. Kothari

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3 TX 05 Thermal Science and Air Conditioning

Course Objectives :

- To understand the properties of steam and use of boilers in textile industries.
- To understand the basic knowledge about fluid dynamics and its application in textile industry.
- To understand the basic knowledge about refrigeration and air conditioning and their applications in textile industries.

Course Outcomes :

At the end of the course, students will be able to-

CO1- To understand the properties of steam, its types and applications in textile field.
CO2- To describe construction and working of different types of steam boilers their accessories and mountings.
CO3- To describe the concept of fluid dynamics and fluid flow applications in textile industries.
CO4- To describe the function of different types of compressors and their applications in textile industry.
CO5- To describe the function of different types of pumps and refrigeration systems.
CO6- To understand the function of the air conditioning system and its applications in textile industries.

SECTION-A

UNIT I: Properties of Steam: Brief overview about the use of steam in textile industries, Formation of Steam,Triple Point and Critical Point, Sensible Heat, Latent Heat, Superheat and Total Heat of Steam. Wet Steam, Dryness Fraction, Internal energy of steam, External work of Evaporation, Specific Volume, Enthalpy, Internal Energy and Entropy of Steam. T-S Diagram and Steam Table and their use. Difference between Vapor and Gas, Dryness Fraction and Measurement of by Separating, Throttling, and Combine Calorimeter, Specific application of steam in textile industries and processes. (6)

UNIT II: Steam Boiler: Flow Diagram for Steam Power Plant with basic units such as Steam Generator, Turbine, Condenser and Pump, Classification of Boilers, Principal Parts of Steam Boiler and their functions, Characteristics of a Good Steam Boiler, Factor Affecting the Selection of Boilers, Historical Review of Fire Tube Boiler and Water Tube Boiler. Introduction of High Pressure Boilers such as LaMont Boiler, Loeffler Boiler, Benson Boiler, and Velox Boiler.Uses of Boiler in Textile Industry such as Spinning, Weaving, Chemical Processing and others.

Boiler Mounting and Accessories :- Boiler Mountings- Devices for proper functioning and safety such as Safety Valve, Water Level Indicator, Pressure Gauge, Fusible Plug, Blow-off Cock, Feed Check Valve, Steam Stop Valves, Man Hole and Mud Box. Boiler Accessories-Devices for improving Boiler Efficiency such as Superheater, Economizer, Air Preheater. Boiler Draught (Draft), Function of Draught, Classification of Boiler Draught. **(6)**

UNIT III: Fluid Dynamics: Introduction to the study of fluid motion its uses in textile industry, Mechanical Properties of Fluids and their influence on flow characteristics, Types of Flows, Stream Lines, Potential Lines, Flow Net, Continuity Equation, Bernoulli's Equation, Venturimeter.

Fluid flow applications in Textile Processing- Air Jet Spinning, Nozzle design and performance in Air Jet Spinning, Spun bonding process of Non-Woven, Fabric like Structures, Textile Wet Processing, Air-Jet and Water Jet weft insertion mechanisms. **(6)**

SECTION- B

UNIT IV: Air Compressor : Introduction, Classification of Air Compressor, Cycle of operation, Use of Compressed air in Textile Industry such as spinning machine and weaving machine, Introduction to Pneumatic System, Study of various Pneumatic Circuit, and its Component, like Valves Filter, Regulator, Accumulator, Lubricator. Application of Pneumatic circuits in Textile Machines. **(6)**

UNIT V: Pump and Refrigeration: Introduction of Pump used in Textile Industry, Classification of Pump, Centrifugal Pumps, main parts & working, work done, efficiency, Brief Introduction of Reciprocating Pump.

Refrigeration- Introduction to Refrigeration, Application of Refrigeration, Elements of Refrigeration System, Unit of Refrigeration, Coefficient of Performance (COP), Various Refrigeration System such as Ice Refrigeration, Air Refrigeration System, Vapour Compression Refrigeration System, Vapour Absorption Refrigeration System. **(6)**

UNIT VI: Air Conditioning: Concept of Psychometry and Psychometrics terms, Definitions, Psychometric Relations, Psychometric Chart, Psychometric Processes- Mixing of Air Streams, Sensible Heating, Sensible Cooling, Humidification, Dehumidification. Methods and Features of Modern Humidification plant in Textile Mills, Effect of Moisture on Textile Fibers, sling Psychrometer, Use of psychometric chart. (Numerical related to psychometric).Importance of Humidity Control in Textile Processing. Air Conditioning System- Introduction, Air Conditioning Cycle, Classification of Air Conditioning System, Central System, Zoned System, Unitary System, Unitary Central System. **(6)**

Books Recommended:-

Text Books :

1) Thermal Engineering-P.L.Balaney.(Khanna Publication)
2) Fluid Mechanics and Hydraulic Machine by Dr.R.K.Bansal
3) A course in Refrigeration and Air Conditioning – S. C. Arora, S. Domkundwar.(Khanna Publication.)

References Books :

1) Refrigeration & Air Conditioning – P. N. Ananthnarayanan. (TMH Publication)
2) Elements of Heat Engine–R.C.Patel, C.J.Karamchandani.(Charter Publication)
3) Thermal Enginneering B.K.Sarkar.(TMH Publication)
4) Thermal Engineering-S.Domkundalwar.(Khanna Publication)
5) A Textbook of Engineering Thermodynamics by R.K.Rajput.
6) Thermal Engineering by R.S.Khurmi & Gupta.
7) Refrigeration & Air conditioning by R. K.Rajput.
8) Pneumatic Systems by Majumdar.
9) Hydraulics & Pneumatics by Andrew &Parr.
10) Humidification & Air conditioning by S. P.Patel.
11) Textile Humidification by K. G.Vaze.

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Semester-IV
4 TX 01 Textile Fibre - II

Course objectives :

1) To gain basic knowledge about polymers and their extrusion methods.
2) To gain the knowledge about major synthetic fibres and their properties.
3) To understand texturing and its various methods.

Course outcomes :

After the completion of Textile Fibre –II course, students will able to demonstrate,

1) the various extrusion methods of synthetic fibres
2) the manufacturing and properties of regenerated fibres
3) the manufacturing and properties of Polyamide and Polyester fibres
4) the manufacturing and properties of Polyacrylonytrile, Polyvinyl and Polyethylene fibres
5) the concepts of mechanical, thermal and optical properties
6) the various methods of texturing

SECTION-A

Unit-I: Manmade fibres: Definitions of regenerated & synthetic fibres, heterochain and carbon chain fibres, Addition and condensation polymerization, Study of intra-polymer and inter-polymer forces in fibre polymer. Concept of thermoplastic and thermoset material. Introduction to melt spinning, dry spinning and wet spinning.

Unit-II: Regenerated fibres: i)Viscose rayon: Manufacturing process, Physical and chemical properties, Applications, ii)Cuprammnium rayon: Manufacturing process, Physical and chemical properties, Applications. iii) High wet modulus and Polynosic rayon: Manufacturing process, Physical and chemical properties, Applications. iv)Introduction to Acetate & Triacetate fibres

Unit-III: Synthetic fibres: i) Polyamide Fibres: Nylon-6, Nylon-66, Raw materials, manufacturing process, Microscopic structure, Physical and chemical properties, Applications. ii) Polyester fibre: Raw materials, manufacturing process, Microscopic structure, Physical and chemical properties, Applications.

SECTION-B

Unit-IV: Synthetic fibres: i) Polyacrylonitrile fibres: Acrylic and Modacrylic fibres: Raw materials, manufacturing process, Microscopic structure, Physical and chemical properties, Applications. ii) Polyvinyl alcohol and Polyvinyl chloride fibres: Raw materials, manufacturing process, Microscopic structure, Physical and chemical properties, Applications. iii) Polyethylene & Polypropylene fibres: Raw materials, manufacturing process, Microscopic structure, Physical and chemical properties, Applications.

Unit-V: Tensile properties: Terms and definitions, Study of stress-strain curve and related properties, importance of tensile properties, factors influencing tensile properties of fibres, Bending and Shear properties, Torsion and Compression properties, Introduction to optical, thermal, frictional and dielectric properties.

Unit-VI: Texturizing: Introduction to various methods of texturizing: Draw Texturising, - sequential (False twist process) and simultaneous draw texturising,. Air Jet Texturizing: - Principle and working of machine. Other Texturising Methods:- Stuffer box crimping, Edge Crimping, Knit-de-knit, Gear crimping. Properties of air and draw textured yarn.

Text Books:

1. Textile Science- Gohl and Vilensky
2. Man Made Fibres – R.W. Moncrieff.

References Books:

1. Hand book of Textile Fibres Vol. I & II by Gordon & Cook.
2. Textile Fibres – Vol.-I by V.A.Shenai
3. Physical Properties of Textile Fibres by W.E. Morton and J.W.S. Hearle,
4. Textile Fibres by H.V.S. Murthy Man Made Fibres – R.W. Moncrieff.

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4TX02 Yarn Manufacturing - II

Course Objectives:

1. To gain basic knowledge about various spinning processes, viz speed frame, ring spinning and doubling.

2. To gain the knowledge about modern aspects of various spinning processes viz speed frame, ring spinning and doubling.

3. To understand various parameters influencing performance of spinning processes.

Course Outcomes:

After the completion of yarn manufacturing course, students will able to -

1. Explain the concept of speed frame process and description regarding speed frame machines.
2. Explain the concept of ring spinning process and description regarding ring spinning machines.
3. Explain the concept of ring spinning process and description about ring spinning machines–principle of drafting, different drafting systems.
4. Explain the concept of ring spinning process and description about ring spinning machines –spinning geometry, spinning triangle.
5. Explain the concept of doubling process and description regarding doubling machines.
6. Explain the concept of fancy yarns and description regarding fancy yarn manufacturing machines.

SECTION- A

Unit-I Speed frame: Objectives, modern speed frame machine, top arm drafting system, flyer, spindle and presser, bobbin and flyer leading winding principle. Differential and building mechanisms. Various parameters affecting roving quality and production. Draft, twist and production calculations. Recent developments in speed frame machine-Auto bobbin transport system etc.

Unit-II Ring frame: Objectives, principle of ring spinning, modern ring frame machine. Details of creel, rings, travelers, importance of ring and traveler profile, balloon control ring, lappet, traveler clearers, suction system. Types of spindles, spindle drives and spindle centering. Building mechanism, building of cops. Compact spinning-principle, different compact spinning systems, structure and properties of compact yarns.

Unit-III Drafting process: Importance, principle of drafting, types of drafting system, top arm drafting system and its advantages, offset drafting, types of draft, top and bottom rollers, cots, aprons, spacers, drafting parameters, different weighing systems- advantages and limitations, factors affecting roller settings and drafting performance, drafting force, roller slip, drafting waves and floating fibres. Production and draft calculations.

SECTION - B

Unit-IV Spinning geometry: Importance, ideal yarn geometry, formation of twist, spinning triangle, spinning angle, spinning tension, balloon formation. Yarn structure and properties. Yarn faults-causes and remedies, end breakages-causes and remedies. Recent developments in ring spinning- ring/travelers systems, automatic doffing, on line quality control, individual spindle monitoring, automatic data acquisition and automatic cop transfer.

Unit-V Doubling: Objectives, types of doubled yarn, effects of twist direction, concept of balance of twist, properties of folded yarn, methods of ply twisting–ring doubling machines, two stage twisting and up twister. Two for one twister- principle, design and constructional details of TFO machine, advantages over ring doubling machine, recent developments in TFO machines, production calculations.

Unit-VI Fancy yarns**:** Basic principle of fancy yarn, classification of fancy yarns, different methods of fancy yarn production - spinning techniques used for the production of fancy yarns, structure of multi-count, slub yarn, spiral, gimp, loop, snarl, knop, covered yarns, diamond, boucle yarns, caterpillar and metallic yarns. Properties and applications of fancy yarns.

Text Books :

1. Manual of Textile Technology by Klein W,
2. A Practical Guide to Ring Spinning by Klein W,
3. Fundamental of Spun Yarn Technology by Lawrence C A,
4. Handbook of Yarn Production by Lord P R,

Reference Books:

1. Drawing, Combing and speed frame by Zoltan, S. Szaloki,
2. Draw frame, combing and speed frame by J. H. Black;
3. Spun Yarn Technology by Eric Oxtoby.
5. Elements of ring frame and doublings by Dr. A. R. Kahre.
6. Advances in Spinning by S. M. Ishtiaque
7. Two for one twister technology by H. S. Kulkarni and HVS Murthy.

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4TX03 Fabric Manufacturing –II

Course objectives :

1) To gain basic knowledge about fabric formation by weaving processes.
2) To gain the knowledge about automatic weaving and dobby shedding.
3) To gain the knowledge about jacquard shedding and various fabric and machines defects.

Course outcomes :

After the completion of Fabric Manufacturing –II course, students will able to demonstrate

1) Knowledge about the concept of fabric forming by weaving
2) Knowledge about the various weaving mechanisms.
3) Kinematics, energy and productivity analysis of shuttle weaving machines
4) Knowledge about the dobby shedding principle and it related machinery
5) Knowledge about jacquard shedding principle & its related machinery.
6) Knowledge about the various warp way, weft way and loom faults.

SECTION-A

Unit I: Classification of different fabric forming process viz. weaving, knitting, breading. Non woven: - Brief description of all methods & there application. Looming: - Working principle of drawing in with respect to plan, twill and satin weave. Study of warp tying, leasing, reaching in, warp knotting and drop pinning processes

Unit II: Weaving:- classification of motions, Shedding:- Classification of shedding principle, types of shed, head movement, shed geometry , reversing motion Brief description about shuttle picking and crank beat up

Unit III: Brief description about warp protection system, weft stop motion and temple**.** Complexity of shuttle picking, kinematics of sley, weaving resistance, bumping condition. Analysis of energy utilization in shuttle picking, limitation of conventional let-up, take-up system. Calculation regarding reed count, average pick, efficiency and production of weaving machine. Automatic loom: - limitation of plain loom and brief description about automatic loom, cop changing mechanism, shuttle protector.

SECTION-B

Unit IV: Historical review of shuttle changing looms. Automatic let-off and positive take up system Historical review of about weft mixing by drop box motion. Dobby shedding: - objectives, classification, climax cam dobby, positive and rotary dobby, method of pegging, dobby setting during weave change

Unit V: Jacquard shedding:- objectives, classification, principal parts , figuring capacity, harness, working principle of Double lift double cylinder jacquard, open shed jacquard, electronic jacquard comparison between various electronic jacquards weave setting of jacquard during weave change

Unit VI: Fabric defect & value less:- Various fabric grading system and its procedure. Fabric defects:- warp and weft defects with causes and remedies, various loom faults with respect to their causes and remedies, various dobby & jacquard related machines and fabric faults with their causes and remedies.

Text Book:

Weaving Machine, Mechanism Management By D.B.Ajagaonkar And M.K.Talukdar .

References Books:

1) Weaving Operation by Allen Armorod
2) Fancy Weaving by K.T. Aswani.
3) Weaving Mechanism vol.II by N.N.Bannarji.
4) Principle of weaving by R. Marks and A.T.C. Robinson.

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4TX04 TEXTILE TESTING — II

Course objectives:

1) To gain knowledge about evaluation of basic fabric properties.
2) To gain knowledge about evaluation of **comfort** properties of textile fabric
3) To gain knowledge about evaluation of basic garment properties by various testing methods.

Course outcomes:

Alter the completion of textile testing—I course, students will able to

I) demonstrate the knowledge about evaluation of service ability of fabric
2) demonstrate the knowledge about the evaluation of dimensional stability of fabric
3) Explain the evaluation of low stress mechanical properties of fabric
4) Demonstrate the knowledge about the evaluation of thermal properties of fabric
5) Demonstrate the knowledge about testing of various parameters of garment
6) Demonstrate the knowledge about quality evaluation of garments

SECTION-A

Unit -I: Fabric Dimension: Length, Width, Thickness, their measurement, Fabric weight per unit area and per length, threads per inch in woven fabric, ends and picks per inch, crimp of yarn in fabric, shrinkage. measurement of crimp, cloth cover and fabric geometry. Serviceability: Introduction, Snagging, Pilling, Factors affecting pilling of fabric Pilling test, Abrasion resistance, factors affecting abrasion resistance. Abrasion tests, wear. Wearer Trials.

Unit -II : Dimensional stability: Introduction, hygral expansion, relaxation shrinkage, swelling shrinkage, felting shrinkage, methods of measuring dimensional stability. Hydraulic bursting strength tester. Tear strength tester .

Flammability terms used relating to flammability, factors affecting flame resistance, flammability testing and flame proofing.

Unit- III : Fabric handle evaluation (Total hand value), Low stress mechanical properties viz.: tensile, shearing, bending, compression and surface friction, Drape, crease recovery, Kawabata system. Colour fastness testing: Introduction, outline of colour fastness tests. Colour fastness to washing, rubbing, light, heat (sublimation), perspiration, sea water, chlorinated water, dry cleaning agents.

SECTION- B

Unit- IV: Comfort: Introduction. Thermal Comfort, heat balance, heat loss, air permeability and its measurement, Effect of air permeability on fabric properties, Measurement of thermal resistance and transmittance of fabrics.

Moisture trasport, sensorial comfort, water absorption, water repellency. Measurement of water vapour permeability and water permeability.

Unit- V: Testing of Garments : Test related to garment appearance and performance such as measurement of seam pucker, seams slippage, seam strength and buffer strength, stitching defects. Different types of defects in fabrics-major and minor faults, fabric inspection system-4 point system

Unit- VI: Quality control in pattern making, grading-maker making, spreading – Quality control of trims and accessories-zippers and buttons. Garments Inspection and measuring guide processing. cutting, stitching in garment industry, tolerance and quality standard for finished garments.

REFFERENCE BOOKS :

1) Principles of Textile Testing – J.E. Booth
2) Physical Testing of Textiles – B.P. Saville
3) Science of Clothing Comfort – V.K.Kothari
4) Testing and Quality Management – V.K. Kothari
5) An Introduction of Quality Control for the Apparel Industry- Pradip V. Mehta.
6) Managing Quality in Apparel Industry – S.K. Bhardwaj and Pradip V. Mehata

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4TX05 GARMENT MANUFACTURING TECHNOLOGY

Course Objectives :

1. To provide the understanding about the scenario of industrial apparel sector.
2. To provide the knowledge about various production processes involved in garment manufacturing.
3. To provide the knowledge about the various industrial production systems and use of CAD and CAM in garment industry.

Course Outcomes :

After completion of the course students will be able to :

1. Explain the apparel industry scenario in form of its structure, types, size, labor, products etc.
2. Explain the various technological aspects and production process involved in pattern making and sizing.
3. Explain the various technological aspects and production process involved in cutting and sewing operations.
4. Explain the various technological aspects and production process involved fusing process.
5. Explain the various technological aspects and production process involved in garment finishing and its inspections.
6. Analyze the various production systems and demonstrate the knowledge about the use of CAD-CAM in garment manufacturingh.

UNIT-I :
World and Indian Scenario of garment industry: Size, various sectors, structure, type of products and business developments in recent years. Overview of export related activities in apparel industry. Brief outline of various steps involved in industrial garment manufacturing process.
Pattern making: Measurement process, size chart and measuring of sizes, definition of various garments parts and positions.

UNIT-II :
Pattern making methods: Bespoke, industrial block method, basic block construction, block preparation and corrections. Figure analysis- body ideals, body proportion, height and weight distribution, body parts, individual figure analysis and body measurement of all age groups. Muslin pattern, commercial pattern, sizes and fabric preparation for garment manufacturing.

UNIT-III :
Types of fabric packages, spreading, marker preparation and its planning, types and functions of cutting machine, preparation for sewing processes,
Sewing: feed systems, types of sewing machinery and equipment, parts of needles and their function,

UNIT-IV :
Sewing thread- Properties, ticket number, classification of seams and stitches.
Fusing- Importance, fusing process, fusing machineries, control of fusing quality. Pressing- Importance, types, pressing equipments.

UNIT-V :
Finishing and inspection: Various components used in garments viz: buttons, zips, underlining, hooks, ornamental materials, sewing labels, motif etc. Garment cleaning and inspection- fitting quality, live models, final inspection of garments, quality standards.

UNIT-VI :
Industrial line production methods: Manual systems, making through, section system, progressive bundle system, straight line system, mechanical transport systems, selective conveyor belt system, unit production system, quick response sewing system.
Ware housing- equipments used in garment handling, storage and packing. Application of CAD and CAM in garment production.

Reference Books :

1. Introduction to clothing Manufacture by Gerry Cooklin
2. Technology of clothing manufacture by Harrold carr & Barbara Lathem
3. Garment Technology by Dr. V.Subramaniam, Winter School booklets 1990
4. Apparel Manufacturing Handbook by Jacob Solinger.
5. Clothing construction and wardrobe planning by Dora S. Lewin, Mabel Goode Bowers, Manetta Knttunen , The Macmillan co New York .

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SEMESTER - III (Practicals)

3TX07 TEXTILE FIBRE - I - LAB.

8 to 10 practicals based on the syllabus 3TX01 **TEXTILE FIBRE – I**

3TX08 YARN MANUFACTURING - I - LAB.

8 to 10 practicals based on the syllabus 3TX02 **YARN MANUFACTURING – I**

3TX09 FABRIC MANUFACTURING - I - LAB.

8 to 10 practicals based on the syllabus **3TX03 FABRIC MANUFACTURING – 1**

3TX10 TEXTILE TESTING - I - LAB.

8 to 10 practicals based on the syllabus 3TX04 **TEXTILE TESTING – I**

SEMESTER - IV (Practicals)

4TX07 TEXTILE FIBRE - II - LAB.

8 to 10 practicals based on the syllabus 4TX01 **TEXTILE FIBRE – II**

4TX08 YARN MANUFACTURING - II - LAB..

8 to 10 practicals based on the syllabus 4TX02 **YARN MANUFACTURING – II**

4TX09 FABRIC MANUFACTURING - II - LAB.

8 to 10practicals based on the syllabus 4TX03 **FABRIC MANUFACTURING – II**

4TX 10 TEXTILE "TES'T'ING - II - LAB.

8 to 10 practicals based on the syllabus **4TX04 TEXTILE TESTING —IT**

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SYLLABI PRESCRIBED FOR FOUR YEAR DEGREE COURSE
BACHELOR OF ENGINEERING (CHEMICAL)
SEMESTER PATTERN (CHOICE BASED CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 CH 01/3 PE 01 APPLIED MATHEMATICS-III / MATHEMATICS-III

1. **Pre-requisite of Subject** : Engineering Mathematics I and Engineering Mathematics II

2 **Course Objectives of Applied mathematics III** :

On Completion of the students are expected
- To understand Fourier transform & Z-transform, Laplace transform & their application to engineering problems.
- To know probability and probability distribution.
- To understand Numerical analysis.
- To know vector Clarks &their application.

SECTION A

UNIT –I: Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7 Hrs.)

UNIT-II: Laplace transforms: Definition, standard forms, properties of Laplace transform, Inverse Laplace transform, Laplace convolution theorem, Laplace transforms and Unit step function, Solution of Linear differential equations. (7 Hrs.)

UNIT-III: Probability & Probability Distribution Probability: definition, axioms of mathematical probability, complementation rule, Theorem of total probability, Theorem of compound probability, Independent Events, subjective probability, Baye's Theorem, Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (7 Hrs.)

SECTION B

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy- Reimann conditions, Harmonic conjugate functions, Milne's method, singular points, expansion of function in Taylor's and Laurent's series, Cauchy's integral theorem and formula, Residue theorem. (7Hrs.)

UNIT-V: Numerical Analysis: Solution of algebric and transcendental equations by method& method of false position, Newton-Raphson method Solution of system of linear equations by Gauss Seidal method, Relaxation method. Solution of first order ordinary differential equations by modified Euler's, method Runge - Kutta method. (7Hrs.)

UNIT-VI: Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem(without proof). (7Hrs.)

Course Outcomes :

Students are expected to expertise in

- Solving numerical methods, Laplace transform, Fourier Transform & Z-transform Probability & Probability Distribution and statistics are very useful to them in future curriculum/student.
- Complex functions and vector calculus are backbone of future academic curriculum and hence should be in touch with contents in syllabus. Design of syllabus is more than sufficient for academic curriculum of student.

Text Books:
1. Higher Engineering. Mathematics by B.S. Grewal, Khanna Publication.
2. A Text Book of Applied Mathematics, Volume-II by P. N. Wartikar and
J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Vidyarthi Griha Prakashan, Pune.

Reference Books:
1. Numerical Analysis- S.S. Sastry.
2. Advancing Engg. Mathematics by E.K.Kreyzig.

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3 CH 02 PROCESS INSTRUMENTAION

Monitoring and control of processes is an important activity of Chemical Engineer. This subject deals with measurement principles of process parameters like temperature, pressure, level flow.

Course Objectives:

The students will be able:

To learn the operating principles, construction and working of temperature, pressure, level and flow measuring devices.

To select the most suitable measuring device based on its performance characteristics for specific measuring task.

To test, Calibrate, Maintain measuring devices elements.

SECTION A

UNIT-I : Basic method of measurements –Errors in measurements – Types of Errors. Transducers – definition – classification – Static characteristics of instruments Dynamic characteristic. Transmitter –definition different types. (8)

UNIT-II : Temperature measurements: Introduction – Temperature scale Conventional methods of temperature sensing. Resistance Thermometer Detector (RTD) – Unbalanced Wheatstone Bridge Direct conversion. Thermistors – Temperature sensing using thermistor – Semiconductor temperature sensor. Thermocouple – Basics of thermocouple – Thermocouple types – Cold junction compensation. Infrared thermometry – Basics of radiation – Emissivity – Methods of sensing –Direct detection – Indirect detection. (8)

UNIT-III: Pressure measurements: Introduction – Units of pressure – Types of pressure measurement- –Bourdon tube and bellows – SG based pressure sensors – Capacitance type pressure transducers. Low pressure measurements – pirani gauge – Thermocouple gauge – Ionization gauge. (8)

SECTION B

UNIT-IV: Basics of fluid flow – Flow meters – Quantum flow measurements, Differential pressure measurement – Principle of the differential pressure flow meter, Orifice plate, Venturimeter, Flow nozzle, Dall tube, Pitot tube. Variable area flow meter,Magnet Flowmeters – DC Magnetic Flow meter, Pulsed Magnetic Flow meter, Permanent Magnet Type Magnetic Flow meter, AC Magnetic Flow meter. Positive displacement Flowmeters – Different type of ultrasonic Flow meter. (7)

UNIT-V : Level Measurements – Level transducer with differential pressure sensing –Capacitance based level sensors – Capacitance sensors for conducting liquids – Capacitance sensors for Non – conducting liquids, other liquid sensors – Displacement type level sensor – Ultrasonic type level sensor, Gamma ray level sensor. (7)

UNIT-VI : pH measurements – Basic ideas of pH value – Measurement of electrode potentials – Glass electrode – Reference electrode – Calomel electrode – Silver- Silver chloride electrode, Humidity Sensing – Basic ideas of humidity sensing – Humidity measurement by dew point sensing – Humidity measurement using Lithium Chloride.
Measurement for Concentration: Obtaining concentration of solution by conductivity and conductivity titration, determination of concentration by density meter, hydrometer, refractometer, measurement of concentration of ion and coloured solution.. (7)

Text Books:

1. Tattamangalam R. Padmanaban “Industrial Instrumentation Principles and Design” Springer, 2000.
2. Donald P. Eckman, “ Industrial Instrumentation”, CBS Publishers, New Delhi,2002.

Reference Books:

1. R.K.Jain, “Mechanical and Industrial Measurements” Khanna Publishers, New Delhi, 1999
2. D.Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill Publishing Ltd, New Delhi, 1999
3. C.D. Johnsons, “Process Control Instrumentation Technology”, Prentice Hall Inc,
4. A.K.Sawhney, “A Course In Electrical and Electronics Measurement and Instrumentation”, Dhanpat Rai and Sons, New Delhi, 1999

3 CH 03 /3CT03 STRENGTH OF MATERIALS

Learning Objectives of Subject:

1. TodeterminetheMechanicalbehavioroftthebodyandconstructionmaterialsbydetermining the stresses, strains produced by the application of loads.
2. To apply the fundamentals of simple stresses and strains.
3. To make one understand the concept of bending and its theoretical analysis.
4. To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course outcomes:

At the end of the subject the students will be able -

1. To understand the basics of material properties, stress and strain.
2. To apply knowledge of mathematics, science, for engineering applications
3. To identify, formulate, and solve engineering & real life problems
4. To design and conduct experiments, as well as to analyze and interpret action and reaction data.
5. To understand specific requirement from the component to meet desired needs within realistic constraints of safety.

SECTION – A

Unit I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

SECTION – B

Unit IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

Unit VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Books Recommended:

1. E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.
2. S.Timoshenko and O. H. Young, 'Elements of Strength of Materials', East West Press Private Ltd., New Delhi.
3. Ferdinard L. Singer, 'Strength of Materials', Harper and Row, New York.
4. Shames, I. H., 'Introduction to Solid Mechanics', Prentice Hall of India, New Delhi.
5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
6. Junnarkar, S. B., Mechanics of materials.
7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
8. Beer and Johston, Mechanics of materials, Mc-Graw Hill.
9. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd.

3 CH 04 : CHEMICAL ENGINEERING THERMODYNAMICS-I

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work- to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Course Objectives:

After studying this subject the student will have:

* The mathematical abilities required for applying thermodynamics to practical problems.
* Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I:BASIC CONCEPTS: The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule. (8)

UNIT-II: FIRST LAW OF THERMODYNAMICS: First law of thermodynamics – heat and energy changes, enthalpy and heat capacity limitations of the first law, application of first law to different processes. (8)

UNIT-III: SECOND LAW THERMODYNAMICS: Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder, refrigeration and liquefaction. (8)

SECTION B

UNIT-IV: REFRIGERATION AND LIQUEFACTION: The carnot refrigerator, the vapour- compression cycle, comparison of refrigeration cycles, liquefaction processes, heat pump. Rankine power cycle. (7)

UNIT-V: THERMODYNAMIC PROPERTIES OF FLUIDS: Property relations for homogeneous phases, thermodynamic diagram, generalized property correlation for gases. (7)

UNIT-VI: THERMODYNAMICS OF FLOW PROCESSES: flow of compressible fluids through ducts, compression processes, steam turbines and nozzles, condensers. (7)

Text Books:

1. J.M. Smith and H.C. Van Ness, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill, 1998.

2. K.V.Narayanan, ."A textbook of Chemical Engineering Thermodynamics", Prentice Hall of India Ltd., 2001.

Reference Books:

1. Sadler S. I., J, "Chemical and Engineering Thermodynamics" John Wiley and Sons, Inc. New York, 3rd Ed., 1999.

2. Elliot J. R. and Lira C.T., "Introductory Chemical Engineering Thermodynamics", Prentice Hall, 1999.

3. Eastop T. D. and McConkey A.," Applied Thermodynamics for Engineering Technologists', Addison Wesley Longman Ltd., England, 5th Ed., 1999.

3 CH 05 PROCESS CALCULATION

Course objectiveS :

1. Students will learn the basic and fundamentals of chemical engineering operations and processes.
2. Students will understand the material balance and energy balance of various unit operations and unit processes.
3. Students will learn how to formulate and solve the problems related to material and energy balance with or without chemical reaction.

Course Outcomes:

After successful completion of this course student will be able to :

1. Understand the concept of basic chemical calculations
2. Understand the concept and application of theory of proportions
3. Determine the humidity with/without using a psychrometric chart.
4. Make the material balance over unit operations and processes.
5. Make the energy balance over unit operations and processes.
6. Solve the problem of fuels and combustion.

Course Contents :

Unit I. Introduction to unit operations and unit processes, Units and dimensions, Atoms, moles and molecular weight, mole and mass fraction, Composition of solids, liquids and gases, Concept of Normality, Molarity and Molality, PPM (Parts Per Million), Ideal Gas Law, Dalton's Law, Partial Pressure, Amagat's Law, Average Molecular Weight,Density of Gas Mixture, Raoult's Law, Henry's Law, Vapour Pressure, Clausius Clapeyron equation, Cox Chart,.Humidity and saturation, Humidity Chart, and their application.

Unit II. Material balance without chemical reaction stoichiometry and unit operations Distillation, Absorption, Extraction, Crystallization, Drying, Mixing, Evaporation. Recycle, purge and Bypass calculations.

Unit III.: Material balance involves chemical reaction, Principle of stoichiometry, simple oxidation reaction, multiple chemical reaction, percentage Conversion, percentage Yield, and selectivity, calculation involving combustion of gases, liquid and solid fuel. Recycle, purge and bypass calculations.
Introduction to unsteady state material balance

Unit IV.: Energy balance: open and closed system, heat capacity, calculations of enthalpy changes, enthalpy changes for phases transitions, evaporation, Solution and mixing, clausius clapeyron equation.

Unit V.: Energy balance with chemical reaction, calculation of standard heat of reaction, heat of formation, heat of combustion, Hess law, Effect of temperature on heat of reaction; adiabatic flame temperature calculations.

Unit VI.: Heating value of fuels, calculations involving theoretical and excess air, heat and material balance of combustion processes.

References :

1. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.
2. Narayanan K V and Lakshmikutty B, Stoichiometry and Process Calculations, Prentice Hall of India Pvt Ltd, New Delhi 2006.
3. Sikdar, D. C., "Chemical Process Calculations", Prentice Hall of India.
4. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
5. Hougen. O. A, Watson K.M. and Ragatz R.A. "Chemical Process Principles, Part -I, Material and Energy Balance".

3CH07 PROCESS INSTRUMENTATION - LAB

List of experiments:

1. Measurement of temperature using thermocouple or RTD or Thermistor and to find their characteristics.
2. Measurement of high temperature using radiation or Optical pyrometer.
3. Measurement of pressure using LVDT or Strain gauge transducer.
4. Calibration of pressure gauge using Dead Weight Tester.
5. Measurement of level using air purge or capacitance type level detector.
6. Measurement of flow using magnetic flow meter or Ultrasonic flow meter.
7. Calibration of thermocouple/Bimetallic thermocouple/Resistance thermocouple.
8. Calibration of Pressure gauge/ Pnuematic pressure recorder/ Differential pressure recorder.
9. Calibration of Orificemeter/ Venturimeter / Rotameter/ Gas flow meter.
10. Estimation of viscosity by Redwood/ Saybolt/ Ostwald viscometer.
11. Calibration of pH meter.
12. Calibration of Conductivity meter.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

3CH08 / 3CE06 – STRENGTH OF MATERIALS – LAB

List of Practical's in Strength of Material Lab (Minimum any eight practical from the list should be performed)

1. Tension test on metals.
2. Compression test on metals.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs.

3CH09 CHEMICAL ENGINEERING THERMODYNAMICS-I–LAB

List of Study Experiments:

- Study 1st law of Thermodynamics

- Study of low temperature refrigeration system.

- Study of ranking power cycle.

- Study of steam nozzles

- Study of steam turbine
- Study of boiler

- Study of mounting accessories of boiler.

- Study of condensers.

- Study of economizer and super-heater.

- Visit to thermal power station.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be studied by the student to complete the term work.

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SEMESTER: FOURTH

4 CH01 APPLIED PHYSICAL CHEMISTRY

Teaching Scheme:	Examination Scheme:
Lecture: 03 Hours / week	Theory
Tutorial: 01 Hour /week	T (E) : 80 Marks T (I) : 20 Marks
(Total credit: 04)	Duration of University Exam : 03 Hours

Learning Objectives:
- To understand the transport phenomenon, internal forces and molecular speed in gases.
- To understand the electrical properties of fluid.
- To know the rate, order, energy of activation of chemical reactions and their determination.
- To know the use of kinetics and thermodynamics to elucidate mechanisms of reactions.
- To understand the basic concepts, the Ist and IInd Laws of Thermodynamics, Thermodynamic functions and their applications.
- To predict the high and low quantum yield photochemical reactions and to know about advanced spectroscopic analysis techniques.
- To know the basic concepts and industrial examples of catalysis and adsorption on surface.

Contents:
Unit-I : Advanced Gas Concepts : Equation of state for real and ideal gases, Van-der-waal's equation, critical phenomenon, calculation of critical constants, Principle of corresponding states, compressibility factor, Principle of equipartition of energy, Maxwell-Boltzmann's law of distribution of molecular speed, Root mean square speed, Average speed and Most probable speed. Numerical. (6 Hrs)

Unit- II : Kinetics & Reaction mechanism: Introduction, Rate of reaction, concept of molecularity and order in elementary and complex reactions, differential and integral methods to formulate rate equations of zero, first and second order reactions. experimental methods in kinetic studies, effect of temperature on reaction rate, energy of activation and its determination, steady state approximation and rate determining step, Mechanism of complex reactions, photochemical chain reactions, polymerization reactions. Fast reactions – experimental techniques. Numerical (10 Hrs.)

Unit-III : Surface, interfacial chemistry and catalysis: Adsorption , types of adsorption, Adsorption isotherms , Langmuir theory of adsorption, BET adsorption isotherm and it's application for determination of surface area of fine powder. Homogeneous and Heterogeneous catalysis, Criteria of catalyst, Theory of heterogeneous catalysis, Homogeneous, Lewis acid-base catalysts, organometallic catalysts and industrially examples, Auto and enzyme catalysis. kinetics of reactions on surfaces. (8 Hrs.)

Unit – IV : Ion transport and electrical phenomenon at interface: Specific, Equivalent and Molar conductivity, Kohlraush's law and its applications ,Transport number and their determination ,Relation between electrical work done and free energy, Nernst equation for electrode potential ,Electrolytic concentration cell with and without transference, Debye- Huckel's theory of strong electrolyte, Determination of pH, solubility and solubility product of sparingly soluble salts, dissociation constant by emf measurement, Numerical. (8 Hrs.)

Unit – V : **Thermodynamics and Equilibrium :** Statements of the second law; Heat engines, Carnot's theorem, and Carnot cycle, Mathematical statement of the second law, Introduction of Entropy under the IInd Law to define spontaneity of a process, Temperature- entropy diagram, Introduction of the state functions A & G to determine conditions of Material Equilibrium. Condition of reversibility, Transformation at constant temperature and pressure, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partialmolar properties, chemical potential, Numerical (8 Hrs.)

Unit VI: **Spectroscopic techniques and applications :** Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Principle and Applications of Nuclear magnetic resonance and magnetic resonance imaging.

Photochemistry and Modern Analytical techniques: Lows of photochemistry, quantum efficiency and its determination, low & high quantum yield reactions, Mass spectrometry. Chromatography. (8 Hrs.)

Course Outcomes :

The course will enable the student to:

- Evaluate the properties of non-ideal gases, Intermolecular forces in gas, critical phenomenon & probability consideration of molecular speed.
- Solve problems involving root mean square, average and most probable speeds & critical constants.
- Evaluate the specific rate, order and energy of activation of chemical reactions.
- Know the fundamental concepts related to homogeneous and heterogeneous catalysis, mechanisms of industrially important reactions, surface phenomenon and adsorption isotherms.
- Apply mass and energy balances to closed and open systems ,Rationalize bulk properties and processes using thermodynamic considerations
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and spectroscopic methods for identification of compounds.
- Know the ion transport & electrical properties of solutions, solve problems involving transport no, electrode potential and emf of different types of cell.

Books Recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy ,Banwell, Tata McGraw-Hill
6. Physical chemistry of surfaces, Arthur W. Adamsons, Alice P. Gast, John Wiley publications
7. Principle of Heterogeneous catalysis, J.M.Thomas, W.J. Thomas, John Wiley publications
8. Thermodynamics for students of chemistry, Dr. J. Rajaram & Dr. J. C. Kuriacose, Chand & comp.

4 CH02 MACHINE DESIGN & DRAWING

SECTION - A

Unit I- (a) Sectional Views Conversion of pictorial view in to sectional orthographic projections, Sectional views with different types of projections, Missing views (12 Hrs)

Unit II- a) Development of surfaces 31 32 Development of surfaces of cubes, prisms, cylinders, pyramids, cones & their cut sections

b) Intersection of solids-prism and prism, cylinder and cylinder, cylinder and prism, cone and cylin-der, cone and prism. (12 Hrs)

SECTION B

Unit III- (a) Meaning of Design, Phases of Design, Design considerations.

(b) Simple stresses, Thermal stresses, Torsional Stress, stresses in straight & curved beams and its application- hooks, cclamps

(c) Design & drawing of riveted joints- Caulking & fullering, failures, strength & efficiency of riveted joints.

(d) Welded joints- Symbolic representation, Strength of transverse & parallel fillet welded section e) Design & drawing of Knuckle Joints (12 hrs)

Unit IV :(a) Design of Helical springs- Types of springs, stresses in helical springs, Wahl's stress factor, Buckling & surge, tension spring (b) spiral & leaf springs c) Design of power screw-Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, acme threads, stresses in power screw. (12 hrs)

Books Recommended :

Text Books :

1) Machine Drawing by N. D. Bhatt, Charator Publication
2) Machine Design by R. S. Khurmi & J. K. Gupta , S. Chand Publication .

Reference Books :

1) Machine Design by Dr. P. C. Sharma & Dr. D. K. Agrawal, Katsons Books publication
2) Design of Machine elements by C. S. Sharma, Kamlesh Purohit, PHI publication
3) Design of Machine elements by V. B. Bhandari, Tata McGraw Hill Publication
4) Machine Design, Jindal, Pearson publications
5) Design Data Book by- P.S.G. Koimbatore
6) Design Data Book by Mahadevan.

(Use of any data book from the above will be permitted during the examination).

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4CH03 FLUID FLOW OPERATIONS

Course Objectives:

This basic course introduces concepts of momentum transfer to students. Various concepts such as pressure, momentum, energy are introduced. Laws related to conservation of momentum, energy are taught. Applications of these laws to various engineering situations and process equipment is explained with the help of several problems

SECTION A

Unit I: Properties of fluids and their classification. Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids. Forces on submerged bodies. Rigid body motion, pressure measurements, Euler's equation. (8)

Unit II: Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Fluid flow: Laminar and turbulent flows, Equations of Continuity and Motion in laminar flows and its applications for the calculation of velocity profiles, shear stresses, power, etc. in various engineering applications. Dimensional analysis; Buckingham's Pi Theorem ; Dimensionless numbers and their physical significance; Vortex flow (8)

Unit III Dynamics of flow , Bernoulli's Equation and engineering applications, Conservation of mass, momentum and energy; Mechanical energy balance ,Basics of Turbulent flows, equations of continuity and motion for turbulent flows: Prandtl mixing length theory,. Turbulent pipe flow, basis of Universal velocity profile and its use. Von-Karman integral equations . Pressure drop in pipes and Fittings, Piping systems. (10)

SECTION B

Unit IV: Flow measuring devices for chemical plants: Orifice meter, Venturi meters, Rotameter, Pitot tube and Notches.

(7)

Unit V : Fluid moving machinery such as pumps like reciprocating pumps, rotary pumps, Centrifugal pumps, blowers, compressors, vacuum systems, etc. . (8)

Unit VI: Flow past immersed bodies, Particle Dynamics, flow through packed bed and fluidized Bed. Introductory concepts of two-phase flow. (6)

Books Recommended:

1. Unit Operations in Chemical Engineering, McCabe Smith: McGraw Hill.
2. Chemical Engineering, Vol. 1, Coulson J. M. and Richardson J. F. Butterworth Heinemann.
3. Fluid Mechanics, F. W. White.
4. A Text book of Fluid Mechanics and Hydraulic Machines ; Dr. R.K.Bansal
5. Fluid Mechanics , R. P. Vyas.

Subject Outcomes :

1 Students should be able to calculate velocity profiles by simplification of equations of motion in simple 1-D flows
2 Students should be able to calculate friction factor, losses in pipe fittings
3 Students will be able to calculate pressure drop, power requirements for single phase flow in pipes
4 Students should be able to calculate two phase gas/liquid pressure drop
5 Students should be able to calculate power requirements, NPSH requirements of pumps
6 Students should be able to calculate drag force and terminal settling velocity for single particles
7 Students will be able to calculate pressure drop in fixed and fluidized beds.

4CH04 CHEMICAL ENGINEERING THERMODYNAMICS-II

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work- to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Course Objectives:
After studying this subject the student will have:

- The mathematical abilities required for applying thermodynamics to practical problems.
- Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: First law of thermodynamics, equation of state, critical properties, Vander Wall's constants, Virial expansions, Redlich-Kwong equation, Beattle-Bridgeman equation.
First law applied to thermodynamic processes and calculations of work, free energy and heat changes. Maxwell relation equation, second law and third law of thermodynamics. Thermodynamics relations based on second law. Relation between Cp and Cv, compressibility factor and coefficient of thermal expansion, concept of residual entropy and entropy of equilibrium. (8)

UNIT-II: Partial molar and apparent molar properties, Gibbs Duhem equation, chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws.

UNIT-III: Colligative properties, Ebulliometric constant. Determination of molecular weight of unknown chemical substances. Solubility law. Vapour liquid equilibrium, T-X-Y diagrams and X-Y diagram for ideal and non ideal system . Raoult's law and Henry's law, Deviations from Raoult's law. Comparison of ideal and non- ideal systems. (8)

SECTION B

UNIT-IV: Phase equilibria in non reacting multi-components, binary and ternary systems. Graphical representation of L/L, L/S and G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Phenol-water systems, Aniline-water-chlorobenzene systems. (7)

UNIT-V: Statistical thermodynamics, thermodynamics probability, its relation with entropy, partition function and its relation with thermodynamic functions, the Boltzman distribution law, Distribution law for chemically reactive system Thermodynamics charts and their uses. Searching of thermodynamics data. (7)

UNIT-VI: Chemical equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, effect of temperature and pressure, Relation between Kp, Kc and Kv, Le-Chatelier's principle. Endo-exothermic reactions. Heterogeneous equilibria, various methods of calculating free enegy charge, equilibrium conversions, case study of feasibility report for manufacture of industrial chemicals. (7)

Text Books:

1. An Introduction of Chemical Thermodynamics: R.P.Rastogi and R.R. Mishra
2. Chemical Engineering Process: Houghen and Watson

Reference Books:

1. Introduction to Chemical Engineering Thermodynamics: J. M. Smith and H. C. Vauhess.
2. Thermodynamics for Chemical Engineering: H. C. Weber and J. P. Meissner.
3. Engineering Thermodynamics: P.K. Nag.

4CH05 CHEMICAL ENGINEERING OPERATIONS–I (MECH. OPERATIONS)

This subject intends to equip the students with concepts and principles as well as construction of equipments used for handling Mechanical Operations in a chemical plant. This subject gives idea about principles of handling mixtures of solids, liquid and gases. This subject will help students for understanding principles for separation and purification techniques of solid, liquids and gases mixtures.

Course Objective: After studying this subject's student will be able to:

- Explain methods of size reduction and equipments working on those principles.

- Describe various equipments used for size separation.

- Identify various other physical properties used for purification solid-solid mixtures and equipments working on this principle.
- Describe various method of purification of heterogeneous mixture of solid liquid, & equipments like filters, settlers, used for separation of solid liquid mixtures.
- Identify various types of agitators used for mixing solids-liquids mixtures, power calculation of a mixer.

SECTION - A

UNIT-I: Size reduction, stages of reduction, equipment operating variables, laws of energies, energy requirements. Screening: Screen analysis, particle size distribution. (7)

UNIT-II: Classification: Equal falling particles, equipment, jigging, tabling. Gravity settling, drag force, terminal settling velocity Sedimentation: Continuous thickners. (8)

UNIT-III: 1. Storage and handling of solids, transportation.

2. Mixing, mixers, agitation, type of equipments. (7)

SECTION - B

UNIT-IV: Filtration: Theory, operation, types, flotation agents, flotation cells Filter calculations, filtration equation for compressible and non- compressible cakes , specific cake resistance. Filtration- constant pressure and constant rate and their equipments. (8)

UNIT-V: Centrifuges: Theory, equipments, types and calculations.

Cyclones: Hydro cyclones, liquid scrubbers and electronic precipitators (7)

UNIT-VI: Adsorption, theory, type and application, Langmuir's Freund Lich;s equation nature of adsorbents, industrial adsorbents. Adsorption on fixed bed, fluidized beds Recent developments in mechanical operations. **(8)**

Text Books:

1. Bedger and Bencharo, "Introduction to Chemical Engineering". Tata McGraw Hill.
2. Narayanan C.M. & Bhattacharya B.C. "Mechanical operations for chemical engineers", Khanna Publishers, 3 rd Ed.1999.

Reference Books:

1. Coulson and Richardson: Chemical Engineering, Vol. 2

2. Brown,G.G. and Associates "Unit operations" Wiley , New York

4CH07 APPLIED PHYSICAL CHEMISTRY- LAB

Total credits: 2 Examination Scheme: (I): 25 (Ext): 25 Marks

Objectives: To provide the practical knowledge of analysis techniques by classical and instrumental methods for developing experimental skill to built technical competence.

List of Experiments:

1. Determination of critical temperature of phenol-water system
2. Determination of order of reaction and specific rate constant of hydrolysis of methyl acetate.
3. Study of kinetics of second order reaction.
4. Determination of relative strength of two acids by kinetic study of reaction
5. Determination of energy of activation of reaction
6. Determination of equivalent conductivity of strong electrolytes at infinite dilution.
7. Determination of transport number
8. Determination of equivalence point of titration by conductance measurement.
9. Potentiometric titration between strong acid and strong base.
10. Verification of Beer- Lambert's law and determination of concentration of unknown solution.
11. Verification of Freundlich and Langmuir isotherm.
12. Determination of refractive index.
13. Determination of solubility of sparingly soluble salts by EMF measurement.
14. Determination of heat of neutralization & ionization of acetic acid
15. Determination of ΔH and ΔS of monobasic acid by measuring its solubility at different temperatures.
16. Determination of specific rotation of cane sugar by polarimetry.

Course outcomes: After completion of this course the students shall be able to ;

1. Understand the objectives of their experiments.
2. Follow the proper and safe procedure to get the accurate results.
3. Record and analyze the results.
4. Interpret the results through proper writing in laboratory journal

Books Recommended :

1. Experiments in Physical Chemistry, David P. Shoemaker, Carl W. Garland, Jeffrey I. Steinfeld
2. Experiments in Chemistry, Dr. D. V. Jahagirdar, Himalaya Publishing House, New Delhi
3. A Text Book of on experiments and calculations- Engg. Chemistry, S.S. Dara, S. Chand & Comp. ltd.

All above experiments are to be arranged in the laboratory. Minimum 08 experiments are required to be performed by the student to complete the term work.

4CH08 FLUID FLOW OPERATION-LAB

Experiments:

- To obtain the coefficient of discharge for the given Venturimeter and obtain its relationship with Reynolds' no.
- To calibrate the given Rotameter.
- To obtain the coefficient of discharge for the given orifice meter and obtain its relationship with Reynolds' no.
- To study the flow and determine critical Reynolds no.
- To determine the discharge co-efficient of the given v-notch.
- To verify the Bernoulli's theorem.
- To determine the viscosity of the given liquids using Stoke's law.
- To determine the viscosity of a given liquid by measuring efflux time of a given tank. Also determine the diameter of a given capillary and compare.
- To determine relation between friction factor and Reynolds number for the given flowing fluid through circular pipe.
- To obtain relation between friction factor and Reynolds number for flow of water through annulus.
- To determine the resistance offered by various pipe fittings and express them in terms of equipment straight pipe length.
- To study characteristics curves for a centrifugal pump.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4CH09 CHEMICAL ENGINEERING THERMODYNAMICS –II -LAB

List of experiments:

- Critical solution temperature of phenol water system.
- Critical solution temperature of phenol water system in presence of impurity like NaCl.
- Critical solution temperature of phenol water system in presence of impurity like succnic acid.
- Determination of boiling point elevation in presence of impurity.
- Determination of freezing point depression in presence of impurity.
- Study of T-X-Y Diagram.
- Lowering of vapour pressure.
- Study of boiling point diagram.
- Study of ternary diagram.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4CH10 CHEMICAL ENGINEERING OPERATIONS-I LAB (MECH. OPERATIONS) -LAB

- To study the performance of Ball Mill and find out it's crushing efficiency.
- To study the performance of Jaw Crusher and find out it's crushing efficiency.
- To study the performance of Crushing Rolls and find out it's crushing efficiency.
- To study the settling characteristics (Free & Hindered settling) of a given suspension of particles.
- To study the filtration characteristics of rotary vacuum filter.
- To study the filtration characteristics of Plate and frame filter press.
- To study the filtration characteristics of Leaf and sparkle filter.
- To carry out differential and cumulative screen analysis of given sample of solid particles.
- To determine energy consumption and crushing law constants for jaw crusher.
- To determine Critical speed of Ball mill & Average particle size of the product obtained in ball mill, **OR** Average particle size of product obtained in Bhrustone mill.
- To determine area of batch thickener by conducting batch sedimentation test.
- To determine efficiency of Cyclone separator.
- To Determine Variation of size reduction in ball Mill by changing the residence time, size of grinding medium and material of grinding medium.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

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SYLLABI PRESCRIBED FOR FOUR YEAR DEGREE COURSE

BACHELOR OF TECHNOLOGY CHEMICAL TECHNOLOGY

SEMESTER PATTERN (CHOICE BASED CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3CT01 APPLIED ORGANIC CHEMISTRY

Course Objectives:

1. Students will get introduced to aromatic compounds, heterocyclic chemistry and natural products, properties and applications of phenols, ethers, epoxides, amines and their derivatives.
2. Student will get the knowledge about the chemistry of unit process, kinetics and mechanism of Nitration, sulphonation and sulphation.
3. Students will get introduces to polymer chemistry and technical preparation of some polymers.

Course Outcomes:

Students will be able to -

1. Analyzed aromaticity and list properties of aromatic compounds.
2. Write simple mechanisms of aromatic reactions.
3. List some of the heterocyclic chemistry and chemistry of natural products.
4. List some properties of amines and their derivatives.
5. Know the unit process like halogenation, sulfonation and nitration.
6. Synthesized some simple organic compounds, polymers and understand the kinetics and mechanism of unit processes.

SECTION-A

Unit I : 1. Aromatic hydrocarbons : Preparation, properties and applications of Benzene, and Naphthalene
2. Heterocyclic compounds: Classification of heterocyclic compounds, preparation, Properties and applications of pyrrole, thiophene, & furan (8 Hrs.)

Unit II : 1.Phenols : Basic concepts, classification, preparation, properties and applications of Phenol, resorcinols, cresols, catechol.

2. Ethers, epoxides and sulphur acids: Methods of preparation, General reaction, ethylene and propyleneoxides – their reactions and applications (8 Hrs.)

Unit III : Amines and their derivatives : Basic concepts, classification of amines, preparation, properties and applications of aniline and Benzene diazonium chloride.
Natural products: Terpenes, alkaloids, plant pigments, their applications (8 Hrs.)

SECTION-B

Unit IV : 1) Study of Chemistry of Unit Process : Nitration, nitrating agents, kinetics and mechanism of aromatic nitration. Technical preparation of nitrobenzene and nitronaphthalene.
2) Study of Chemistry of Unit Process : Sulphonation and Sulphation : Sulphonating & Sulphating agents, kinetics of mechanism of sulphonation. Technical preparation of Sulphonation of Benzene (8 Hrs.)

Unit V : 1) Study of Chemistry of Unit Process : Halogenation : Halogenating agents, thermodynamics, kinetics Technical preparation of DDT and Vinyl chlorides.
2) Principles of polymer chemistry and practices: Classification of polymerization. Types of polymers. Technical preparation of Polyvinylchloride, Bakelite. (10 Hrs.)

Unit VI: 1) Carbohydrates: Basic concepts, classification, industrial applications of glucose, sucrose and starch.
2) Chemicals in food products: Study of preservatives, sweetening agents and antioxidants. (6 Hrs.)

Books Recommended :
1) Organic Chemistry (Vol. I & II): I.L.Finar, Longman Group Ltd. And the English Language Book Society, London, 6th edition.
2) Advance Organic Chemistry: Fieser and Fieser, Asia Pub. House, Mumbai, 1961.
3) Unit Process in Organic Synthesis: P.H.Groggins, McGraw Hill, 5th edition.

3CT02 APPLIED PHYSICAL CHEMISTRY

Teaching Scheme:	Examination Scheme:
(Th)Lecture: 03 Hours / week	
Tutorial: 01 Hour /week	T (U) : 80 Marks T (I) : 20 Marks
Total credit: 04	Duration of Univ. Exam : 03 Hours

Learning Objectives:

- To understand the effect of structure on properties of polymer, concept of weight average and number average molecular weight of macromolecules.
- To understand the electrical properties of fluid.
- To know the rate, order, energy of activation of chemical reactions and their determination.
- To know the use of kinetics and thermodynamics to elucidate mechanisms of reactions.
- To understand the basic concepts, the Ist and IInd Laws of Thermodynamics, Thermodynamic functions and their applications.
- To predict the high and low quantum yield photochemical reactions and to know about advanced spectroscopic analysis techniques.
- To know the basic concepts and industrial examples of catalysis and adsorption on surface.

Course outcomes :

The course will enable the student to:

- Evaluate the structural properties of macromolecules, average molecular weight determination of polymers by various methods.
- Evaluate the specific rate, order and energy of activation of chemical reactions.
- Know the fundamental concepts related to homogeneous and heterogeneous catalysis, mechanisms of industrially important reactions, surface phenomenon and adsorption isotherms.
- Apply mass and energy balances to closed and open systems ,Rationalize bulk properties and processes using thermodynamic considerations
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and spectroscopic methods for identification of compounds.
- Know the ion transport & electrical properties of solutions, solve problems involving transport no, electrode potential and emf of different types of cell.

Contents:

Unit- I : Ion transport and electrical phenomenon at interface: Specific, Equivalent and Molar conductivity, Kohlraush's law and its applications ,Transport number and their determination ,Reversible and reference electrode , Thermodynamics of reversible electrode, Relation between electrical work done and free energy, Nernst equation for electrode potential , Standard electrode potential , Electrolytic concentration cell with and without transference, Determination of pH, solubility and solubility product of sparingly soluble salts, dissociation constant by EMF measurement, Numerical. (8 Hrs.)

Unit-II : Polymer science: Number average and weight average molecular weight of macromolecule, Methods of molecular weight determination of macromolecules, Membrane osmometry, Light scattering, sedimentation and ultracentrifuge methods, Effect of polymer structure on properties of polymers. Numerical on molecular weight determination. (6 Hrs)

Unit- III : Kinetics & Reaction mechanism: Introduction, Rate of reaction, concept of molecularity and order in elementary and complex reactions, differential and integral methods to formulate rate equations of zero, first and second order reactions. experimental methods in kinetic studies, effect of temperature on reaction rate, energy of activation and its determination, steady state approximation and rate determining step, Mechanism of complex reactions, photochemical chain reactions, polymerization reactions. Fast reactions – experimental techniques. Numerical (10 Hrs.)

Unit-IV : Surface, interfacial chemistry and catalysis: Adsorption , types of adsorption, Adsorption isotherms , Langmuir theory of adsorption, BET adsorption isotherm and it's application for determination of surface area of fine powder. Homogeneous and Heterogeneous catalysis, Criteria of catalyst, Theory of heterogeneous catalysis, Homogeneous, Lewis acid-base catalysts, organometallic catalysts and industrially examples, Auto and enzyme catalysis. kinetics of reactions on surfaces. (8 Hrs.)

Unit – V : **Thermodynamics and Equilibrium :** Statements of the second law; Heat engines, Carnot's theorem, and Carnot cycle, Mathematical statement of the second law, Introduction of Entropy under the IInd Law to define spontaneity of a process, Temperature- entropy diagram, Introduction of the state functions A & G to determine conditions of Material Equilibrium. Condition of reversibility, Transformation at constant temperature and pressure, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partialmolar properties, chemical potential, Numerical. (8 Hrs.)

Unit VI: Spectroscopic techniques and applications : Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Principle, Instrumentation and Applications of IR, UV & NMR spectroscopy

Photochemistry and Modern Analytical techniques: Lows of photochemistry, quantum efficiency and its determination, low & high quantum yield reactions, Atomic absorption spectroscopy, chromatography. (8 Hrs.)

Books Recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy ,Banwell, Tata McGraw-Hill
6. Physical chemistry of surfaces, Arthur W. Adamsons, Alice P. Gast, John Wiley publications
7. Principle of Heterogeneous catalysis, J.M.Thomas, W.J. Thomas, John Wiley publications
8. Thermodynamics for students of chemistry, Dr. J. Rajaram & Dr. J. C. Kuriacose, Chand & comp.

3 CH 03 /3CT03 STRENGTH OF MATERIALS

Learning Objectives of Subject:

1. TodeterminetheMechanicalbehaviorofthebodyandconstructionmaterialsbydetermining the stresses, strains produced by the application of loads.
2. To apply the fundamentals of simple stresses and strains.
3. To make one understand the concept of bending and its theoretical analysis.
4. To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course outcomes:

At the end of the subject the students will be able -

1. To understand the basics of material properties, stress and strain.
2. To apply knowledge of mathematics, science, for engineering applications
3. To identify, formulate, and solve engineering & real life problems
4. To design and conduct experiments, as well as to analyze and interpret action and reaction data.
5. To understand specific requirement from the component to meet desired needs within realistic constraints of safety.

SECTION – A

Unit I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

SECTION – B

Unit IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

Unit VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Books Recommended:

1. E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.
2. S.Timoshenko and O. H. Young, 'Elements of Strength of Materials', East West Press Private Ltd., New Delhi.
3. Ferdinard L. Singer, 'Strength of Materials', Harper and Row, New York.
4. Shames, I. H., 'Introduction to Solid Mechanics', Prentice Hall of India, New Delhi.
5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
6. Junnarkar, S. B., Mechanics of materials.
7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
8. Beer and Johston, Mechanics of materials, Mc-Graw Hill.
9. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd.

3CT04 APPLIED THERMODYANICS

Course Learning Objectives :

1. To study the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. To study the laws of thermodynamics and their applications
3. To study the properties of steam, work done and concept of heat transfer
4. To study the air standard cycles

Course Outcomes :

Students will be able to

1. Understand the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. Apply first law of thermodynamics and application of first law to flow and non-flow processes
3. Apply second law of thermodynamics and understand concept of entropy
4. Understand the properties of steam, work done and heat transfer during various thermodynamics processes with steam as working fluid
5. Understand the concept of air standard cycles

SECTION – A

Unit-I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant.

Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams (10 hrs)

Unit-II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Application of first law to non-flow processes, Change in internal energy, work done and Heat transfer during various non-flow processes. (7 hrs)

Unit-III: First Law applied to flow processes: Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9 hrs)

SECTION – B

Unit-IV: Second Law of thermodynamics: Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Plank and Clausious statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem and its corollary, The thermodynamic temperature scale, Reverse Carnot cycle, Inequality of Clausius. Introduction to Entropy, availability and irreversibility. Principle of increase of entropy. (8Hrs)

Unit-V: Properties of Steam: Triple point and critical point, Sensible heat, latent heat, superheat and total heat of steam. Wet steam, dryness fraction, Internal energy of steam, External work of evaporation, internal latent hear, Specific volume, enthalpy, internal energy and entropy of steam. T-S diagram Mollier chart, Steam tables and their use. Work done and heat transfer during various thermodynamics processes with steam as working fluid. Throttling of steam, determination of dryness fraction using various calorimeters. (8 Hrs)

Unit VI : Air Standard Cycles: Ottto, diesel, semidiesel, Brayton, Sterling and joule cycles etc., their efficiencies and mean effective pressure, comparison of auto, diesel and duel cycles.

Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. (No numerical on this unit) (numerical on air standard cycle) (8 Hrs)

BOOKS RECOMMENDED:

Text Books :

1. Engineering Thermodynamic - by P. K. Nag.
2. Fundamentals of Engineering Thermodynamics; R. Yadav;
3. Thermodynamics Basics and Applied: by V. Ganeshan
4. Thermal Engineerirng: by Mahesh M. Rathore.

Reference Books :

1. Basic Engineering Thermodynamics - by Reyner Joel
2. Thermodynamics - by C.P. Arora.
3. Fundamentals of Classical Thermodynamics - by G. J.Vanwylen.
4. Engineering Thermodynamics; P. Chattopadhyay; Oxford
5. Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson.

3CT05 PROCESS CALCULATION

Course objectives :

1. Students will learn the basic and fundamentals of chemical engineering operations and processes.
2. Students will understand the material balance and energy balance of various unit operations and unit processes.
3. Students will learn how to formulate and solve the problems related to material and energy balance with or without chemical reaction.

Course Outcomes:

After successful completion of this course student will be able to

1. Understand the concept of basic chemical calculations
2. Understand the concept and application of theory of proportions
3. Determine the humidity with/without using a psychrometric chart.
4. Make the material balance over unit operations and processes.
5. Make the energy balance over unit operations and processes.
6. Solve the problem of fuels and combustion.

SECTION A

Unit I: Introduction to unit operations and unit processes, Units and dimensions, Atoms, moles and molecular weight, mole and mass fraction, Composition of solids, liquids and gases, Concept of Normality, Molarity and Molality, PPM (Parts Per Million), Ideal Gas Law, Dalton's Law, Partial Pressure, Amagat's Law, Average Molecular Weight,Density of Gas Mixture, Raoult's Law, Henry's Law, Vapour Pressure, Clausius Clapeyron equation, Cox Chart,.Humidity and saturation, Humidity Chart, and their application.

Unit II : Material balance without chemical reaction stoichiometry and unit operations Distillation, Absorption, Extraction, Crystallization, Drying, Mixing, Evaporation. Recycle, purge and Bypass calculations.

Unit III : Material balance involves chemical reaction, Principle of stoichiometry, simple oxidation reaction, multiple chemical reaction, percentage Conversion, percentage Yield, and selectivity, calculation involving combustion of gases, liquid and solid fuel. Recycle, purge and bypass calculations.
Introduction to unsteady state material balance

SECTION B

Unit IV : Energy balance: open and closed system, heat capacity, calculations of enthalpy changes, enthalpy changes for phases transitions, evaporation, Solution and mixing, clausius clapeyron equation.

Unit V: Energy balance with chemical reaction, calculation of standard heat of reaction, heat of formation, heat of combustion, Hess law, Effect of temperature on heat of reaction; adiabatic flame temperature calculations.

Unit VI : Heating value of fuels, calculations involving theoretical and excess air, heat and material balance of combustion processes.

References :

1. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.
2. Narayanan K V and Lakshmikutty B, Stoichiometry and Process Calculations, Prentice Hall of India Pvt Ltd, New Delhi 2006.
3. Sikdar, D. C., "Chemical Process Calculations", Prentice Hall of India.
4. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
5. Hougen. O. A, Watson K.M. and Ragatz R.A. "Chemical Process Principles, Part -I, Material and Energy Balance".

3CT06 APPLIED ORGANIC CHEMISTRY- LAB

Course objectives:

1. Students should be familiar with common organic compounds, should identify them and should know simple organic preparation and separationmethods.
2. Students will get introduced to aromatic compounds, heterocyclic chemistry and natural Products.

Course outcomes:

1. Students will be able to list steps for identifying simple organic compounds
2. Students will be able to list some methods of separation of organic compounds
3. Student will be able to synthesize simple organic compounds.

Content:

1. Identification of an organic compound through elemental analysis, group detection, physical constants (m.p and b.p) and derivatisation.
2. Separation and purification of binary mixtures of the type: water soluble-water insoluble, both watersoluble, liquid-liquid by distillation, dissociation - extraction , crystallization, etc.
3. Simple organic preparations:
   i) Acetanilide
   ii) Nitro Acetanilide
   iii) Aspirin

Books Recommended:

1. Practical Organic Chemistry, by I.L. Finar
2. Laboratory hand book of organic qualitative analysis and separation, by Kulkarni V. S. D. Ramchandra & co. Pune.

3CT07 APPLIED PHYSICAL CHEMISTRY- II - LAB

Total hours / week : 2 Examination Scheme: (I): 25, (Ext): 25 Marks
Total credit: 1

Course Objectives: To provide the practical knowledge of analysis techniques by classical and instrumental methods for developing experimental skill to built technical competence.

List of Experiments:

1. Determination of viscosity average molecular weight of polymer.
2. Determination of order of reaction and specific rate constant of hydrolysis of methyl acetate.
3. Study of kinetics of second order reaction.(Saponification of ethyl acetate & reaction between potassium per sulphate & potassium iodide)
4. Determination of relative strength of two acids by kinetic study of reaction
5. Determination of energy of activation of reaction
6. Determination of equivalent conductivity of strong electrolytes at infinite dilution.
7. Determination of transport number by EMF measurement.
8. Determination of equivalence point of titration by conductance measurement.
9. Potentiometric titration between strong acid and strong base.
10. Verification of Beer- Lambert's law and determination of concentration of unknown solution.
11. Verification of Freundlich and Langmuir isotherm.
12. Determination of refractive index.
13. Determination of solubility of sparingly soluble salts by EMF measurement.
14. Determination of heat of neutralization & ionization of acetic acid
15. Determination of ΔH and ΔS of monobasic acid by measuring its solubility at different temperatures.
16. Determination of specific rotation of cane sugar by polarimetry.

All above experiments are to be arranged in the laboratory. Minimum 08 experiments are required to be performed by the student to complete the term work.

Course outcomes: After completion of this course the students shall be able to :

1. Understand the objectives of their experiments.
2. Follow the proper and safe procedure to get the accurate results.
3. Record and analyze the results.
4. Interpret the results through proper writing in laboratory journal

Books Recommended :

1. Experiments in Physical Chemistry, David P. Shoemaker, Carl W. Garland, Jeffrey I. Steinfeld
2. Experiments in Chemistry, Dr. D. V. Gahagirdar, Himalaya Publishing House
3. A Text Book of on experiments and calculations- Engg. Chemistry, S.S. Dara, S. Chand & Comp. ltd.

3CT08 / 3CH08 – STRENGTH OF MATERIALS – LAB

List of Practical's in Strength of Material Lab (Minimum any eight practical from the list should be performed)

1. Tension test on metals.
2. Compression test on metals.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs.

3CT09 APPLIED THERMODYNAMICS – lab.

Minimum 8 10 10 Practicals based on the Syllabus 3CT09 APPLIED THERMODYNAMICS.

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SEMESTER - IV

4CT01 MATHEMATICS - II

Course Outcomes:

After successfully completing the course, the students will be able to

1. Demonstrate the knowledge of partial differential equations, applied to Computer technology.
2. Find roots of complex numbers, separate the complex quantity in real & imaginary parts, and find logarithms of negative numbers and complex quantities.
3. Compute different Numerical Methods
4. Analyze the Knowledge of Optimization.
5. Analyze the concept of Linear Programming Problems and Simplex Method
6. Demonstrate the basic concepts of probability and statistics

Students are expected to be aware of the statements of the relevant theorem without mastering their proofs.

Unit I :Partial Differential Equations : Basic concepts (@J 1.1), Vibrating string (@11.2), separation of variables (@11.3), one dimensional heat flow(@11.5), 11.6) (07 periods)

Unit II: Complex Numbers and Analytic functions : Complex numbers(@12.1), polar fonn(@12.2),Complex function limit, derivative analytic function (@12.4), Cauchy Riemann Equations, Laplace's Equation(@12.5), rational functions(@12.6), Exponential function (@12.7), Trigonometricand hyperbolic functions (@12.8), logarithm (@12.9) (07 periods)

Unit III : Numerical Analysis : Errors in computation (@19.1), Solution of Equations by iteration, Newton - Raphson method (@19.2) Finite differences{@19.3}, Interpolation (@19.4), Numerical integration using rectangular, trapezoidal and Simpson's rule (07 periods)

Unit IV : Optimization : Basic concepts (@22.1), Linear programming{@22.2), Simplex method{@22.3),(@~2.4) (07 periods)

Unit V : Probability and Statistics : Sample mean and variance (@23.3), probability (@23.S),Permutations and combinations (@23.6), discrete and continuous distributions (@23.7), mean and variance of adistribution (@23.8), Binomial, Poisson distributions (@23.9),Normal distribution (@23.10) (07 periods)

Unit VI : Probability and Statistics (continued) : Random sampling (@23.12), Estimation of parameters (@23.13),confidence intervals (@23.14), Testing of hypothesis (@23.15) (07 periods)

Note : Numbers in bracket refer to section number; T1 "AdvancedEngineering Maths" by Erwin Kreyszig (Finn jdn), WileyEastern.

Books Recommended :

1) Elements of Applied Mathematics: P.N. Wartikar& J.N. Wartikar,
2) A text book of Applied Mathematics: P. N. Wartikar& J. N. Wartikar,
3) Advanced Engg. Mathematics - Erwin Kreyszig, Wiley Eastern (5thEdition),
4) Higher Engg. Mathemetics . B.S.Grewal.
5) Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI
6) 4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

4FT02 FOOD TECHNOLOGY-I:

CHEMISTRY OF FOODS :

Development of Food Chemistry : History of Food Chemistry. Nature and Origin of life. Basic activities of animals and plants and their relations. Water and Ice: Importance of water in foods. Structure of water and ice. Concept of bound and free water and their implications.

Carbohydtrates :- Nomenclature, Classification and structure of Carbohydrates. Chemical reactions of carbohydrates. Physical and Chemical properties of sugars, starch, pectic substances, gums and other polysacchrides, Functional properties of carbohydrates in foods.

Lipids: Definition and classification of lipids, Chemistry of fatty acids and glycerides, Physical and chemical characteristics. Chemistry of processing of fats and oils, hydrogenated fats, shortening agents and confectionery fat etc. Rancidity of fats and oils, its prevention and antioxidants. Functional properties of lipids in foods.

Protein: Importance of proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides and proteins Sources and distribution of proteins. Isolation identification and purity of proteins, Denatruation Functional properties of proteins in food.

Fruits and Vegetables: Plant Cells and tissues, their structure, functions and physiology, Chemical Composition of edible plant tissue. Texture of fruits and vegetables. Effects of cooking on texture and composition of fruits and vegetables.

Meat. Fish and Poultry : Animal Proteins, Structure and chemical composition of muscles, **Myoglobin and hemoglobin** - Post - Mortem charges regor mortis. Methods of cooking and processing and their influence on texture. Physical and chemical changes during cooking Palatability characters; texture and tenderness. Structure and composition of eggs. Chemistry and functional properties of eggs.

Milk and Milk Products : Composition of milk, Physical and chemical properties of milk protein and effects of processing on these. Chemistry of milk product like cheese, cream, butter, ghee etc

Miscellaneous: Sensory perception of tests and flavors. .Browing reactions, Nutritive and non-nutritive sweeteners. Food dispersions and their implications on foods.

Books Recommended :

1. Food Chemistry by L.H. Meyer, Publishers, Van Nostrand Reinhold Co.New York, Latest Edition.
2. Principles of Food Science- Edited by Owen R. Fennema, Part I Food Chemistry, Publishers Marce Dekker, Inc. New York.
3. The Chemical Analysis of Foods and Food Products : Morries, B.Jacobs 3rd Edition, Publishers Van. Nostrand Company, INC. Princeton, New.
4. Introduction to the Biochemistry of Foods by J..B.S. Braverman, Publishers Elsevier Publishing Co. Amsterdam, Latest Edition.
5. The Spice Hand Book by J. W.Patty, Publishers Chemical Publishing Co. Inc.New York, Latest Edition.
6. Food Theory andApplication by Paul, Pauline and Palmer, Helen H., Publishers, John Wiley and Sons. NewYork,. Latest Edition.

4PT02 PULP AND PAPER TECHNOLOGY-I

CHEMISTRY OF WOOD AND PULP OF PAPER MATERIALS:

Species, anatomy and physical properties of Wood:-

Classification of woods, plants used in pulp and paper, gross structure of trunk, structure elements of wood, fiber dimensions water conducting system, food conducting system, reactions of wood, bark and its structural elements, dec of wood, physical properties of wood. Fiber morphology: Cell formation and growth, fiber structure, chemical composition of wood, non-wood fibers used in pulping bast, fruits, grass, leaf, animal, mineral and synthe: icfibers

Cellulose: Chemistry and location in the cell, isolation molecular constitution, microfibrils, crystalline and amorphoupus Pulp of Paper biogenesis of the cell wall, Polysacchrides, sorption, swelling and solution of cellulose, degradation reactions of pulp of paper.

Hemicelluloses : Structure and properties of hemicelluloses.

Lignin: Lignification in wood, biological and biochemical aspects of lignin information, structure and properties of lignin, separation of lignin from woodytissues and Fiber laboratory separation, commercial separation, analysis of'lignin and utilization of Lignin.

Books Recommended :

1. "The Chemistry of Cellulose" by Emil Hauser, John Wiley & Sons, New York.
2. "The Methods of Cellulose Chern. " by Charles Dorce, Chapman & Hall, L.
3. High Polymers Vol V (Part-I to V) edited by Emil Ott& Others, Interscience Publishers.
4. Publishing Processes by S.A.Rydholm, John Wiley & Sons, Inc.,New York.
5. Pulp &Paper : Chemistry & Chemical Technology by James P. Cascy.

4OT02 OIL & PAINT TECHNOLOGY-I

(CHEMISTRY OF OIL AND FATS & INTRODUCTION OF PAINTS)

Natural Fats : Their Sources, classification and composition Constituents of natural fats : Glycerides, Phospholipids, Fatty acids, non-glycerides constituents, toxic constituents and detoxication, Nutritional functions of Fats. **Glycerides and fatty acids :** Nomenclature, Structure, occurrence in fats. Physical properties of fats and fatty acids. Elementary ideas on their liquid properties, solution properties and spectral properties.

Chemical reaction of fats and their fatty acids. Chemistry of hydrogenation, hydrogenolysis, autoxidation, polymerisation dehydration, pyrolysis, halogenation, sulpation and sulphonation , esterification , interesterification and hydrolysis. Chemical Oxidation of fatty acids, Significance and importance of these reactions. Rancidity Of Oils & Fats, . Oils Antioxidant and Synergists.

Physical and Chemical characteristics : Indian standards for oils and fats - ISI Specifications of Oilseeds, Oils, DOC, Vegetable Ghee . Identification of fats. Detection of adulteration in fats and Indian standards for oils and fats. **Introduction of Paints**, Types Of Paints, Basic Ingredients of Paint System, Industrial Applications of Paints , Recent development in the field of Oils & Paints.

Books Recommended :

1. Industrial Oil and Fat Products Ed. : A.E.Bailey. Interscience & Sons New York, London, Sydney 5th Edn.
2. An Introduction of the Chemistry and Biochemistry of Fatty Acids : Gumstone.
3. Progress in the Chemistry of Fats and other liquids (Vols. 1 to 11) T.R.Holmann, Pergamon Press.
4. Fatty Acids : K.S.Markley, Inter Sc.Publishers, 2nd edition, New York.
5. Industrial Chemistry of Fats and Waxes : T.Hilditch Balliere Tindall and Cox, London 2nd Edition.
6. Rancidity of Edible Fats : C.H.Lea, His Majesty's Stationary Office, London, Latest Edition.
7. Analysis of Fats and Oils : V.V.Mellen Bacher, Garrard Press Publishers, Illinois, Latest Edition.
8. Outline of Paint Tech. - H.Hea
9. Introduction of paints by Morgan.

4PC02 PETROCHEMICAL TECHNOLOGY - I

Course Objectives: Basic Concepts of Chemistry of Hydrocarbons, Introduction to Basic Refinery Processes. Formation Theories of Petroleum. Exploration and prospecting for petroleum and gas field, Drilling. Transportation, Storage of Petroleum & Products and future Energy Sources.

Course Outcomes:

1) Students will be able to understand the chemistry and composition of petroleum.

2) Students will be able to understand the importance petroleum as a source of energy and petrochemicals

3) Students will be able to understand the technology involved in exploration and prospecting for petroleum and gas field, as well as drilling for petroleum.

Unit-I: Origin, Occurrence, and Formation of crude petroleum. History of Indian Petroleum and Refining Industry and future trends. Hydrocarbon resources in India, history. World Petroleum Scenario, world Petroleum Reserves and Deposits. Crude Oil and Natural Gas Production and Consumption in India. Petroleum refineries in India, their location, year of commissioning, and organizations, Refining Capacity& throughput, Production& Consumption of Petroleum Products. Advantages and disadvantages of petroleum.

Unit-II: Composition, Chemistry, Classification of Petroleum Hydrocarbon composition of petroleum and petroleum products (liquid and gas).Non-hydrocarbon compounds in petroleum. Properties of hydrocarbons and non-hydrocarbons. Classification and description of crude oils and petroleum gases.

Unit-III: Refining Processes and Operations Various refining processes, operations and chemistry involved. Principle involved in dehydration, desalting and conditioning of crude oil. Thermodynamics, kinetics and reaction mechanism, principle involved in thermal and catalytic processes such as thermal and catalytic cracking, hydro cracking, reforming, isomerisation, polymerization, alkylation.

Unit-IV: Exploration and prospecting for petroleum and gas field Structure of earth and of the earth crust, formation of Sedimentary rocks, Exploration and prospecting for petroleum and gas field, Geological, Geophysical, Geochemical prospecting methods, geophysical borehole logging methods. Migration of petroleum and gas deposits and commercial petroleum accumulations. Petroleum traps and their classifications. Development of an oil or gas field.

Unit-V: Drilling for Petroleum Drilling operation, Cable tool method, Rotary drilling, Turbo drilling, types of drill bits, mud fluids, casing off formations, Deviation of holes, Directional drilling, Offshore drilling rigs, Well control systems.

Unit-VI : Other Sources of Hydrocarbons, Transportation& Storage of Petroleum Sources of hydrocarbons other than crude oil, future automotive fuel resources, new and future energy sources. Transportation and storage of crude oil, petroleum gases, and petroleum products. Shipping tankers, Pipelines: Materials and Corrosion, Onshore and offshore pipeline construction. Pipeline network in India.

Books Recommended :

1) Modern Petroleum Refining Processes by B. K. BhaskaraRao, Latest Edition.

2) Chemistry of Petrochemical Processes by Sami Matar, Lewis F. Hatch

3) The Chemistry and Technology of Petroleum by James G. Speight

4) Fundamentals of Petroleum and Petrochemical Engineering by Uttam Ray Chaudhuri

5) Modern Petroleum Technology Volume-I Upstream Edited by Richard A. Dawe

4 CT03 / 4CH02 MACHINE DESIGN & DRAWING

SECTION - A

Unit I- (a) Sectional Views Conversion of pictorial view in to sectional orthographic projections, Sectional views with different types of projections, Missing views (12 Hrs)

Unit II- a) Development of surfaces 31 32 Development of surfaces of cubes, prisms, cylinders, pyramids, cones & their cut sections

b) Intersection of solids-prism and prism, cylinder and cylinder, cylinder and prism, cone and cylin-der, cone and prism. (12 Hrs)

SECTION B

Unit III- (a) Meaning of Design, Phases of Design, Design considerations.

(b) Simple stresses, Thermal stresses, Torsional Stress, stresses in straight & curved beams and its application- hooks, cclamps

(c) Design & drawing of riveted joints- Caulking & fullering, failures, strength & efficiency of riveted joints.

(d) Welded joints- Symbolic representation, Strength of transverse & parallel fillet welded section e) Design & drawing of Knuckle Joints (12 hrs)

Unit IV :(a) Design of Helical springs- Types of springs, stresses in helical springs, Wahl's stress factor, Buckling & surge, tension spring (b) spiral & leaf springs c) Design of power screw-Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, acme threads, stresses in power screw. (12 hrs)

Books Recommended :

Text Books :

1) Machine Drawing by N. D. Bhatt, Charator Publication
2) Machine Design by R. S. Khurmi & J. K. Gupta , S. Chand Publication .

Reference Books :

1) Machine Design by Dr. P. C. Sharma & Dr. D. K. Agrawal, Katsons Books publication
2) Design of Machine elements by C. S. Sharma, Kamlesh Purohit, PHI publication
3) Design of Machine elements by V. B. Bhandari, Tata McGraw Hill Publication
4) Machine Design, Jindal, Pearson publications
5) Design Data Book by- P.S.G. Koimbatore
6) Design Data Book by Mahadevan.

(Use of any data book from the above will be permitted during the examination).

4CT04 MATERIAL SCIENCE & ENGINEERING

SECTION-A

Unit I : Crystalline and non crystalline structure sensitive and insensitive properties and defects in crystals. Co-relation of mechanical properties with reference to structure.

Unit II: Effect of temperature on mechanical properties various rnethods of improving the strength failure under service conditions

Unit III : Solid solutions phase diagrams and their relation to meta properties with reference to steels and cast irons.

SECTION-B

Unit IV : Heat treatment of steels and common on ferrous alloyes.

Unit V: Elastomers and plasiomers, molecular structure and properties of polymers, ceramic materials and refractoriness, High ternperature oxide ceramics glasses and their properties, composite materials.

Unit VI : Corrosion: Electrode potentials e.m.f and galavanic series, polarization forms of corrosion, rate factors, inhibition, prevention, control and testing, Corrosion behaviour of metals and alloys chemical resistance of polymers, Forming processes and corrosion. Non destructive methods of testing, Metallic, Plastic and other protective coatings.

Books Recommended :

1. Nature and properties of Engineering Materials by D.Jastrebski.
2. Introduction to Materials science by Guy.
3. Materia! Science and Processes by SK.Hajra Chaudhry
4. Material Science for Engineers by Van Valack.

4CT05 FLUID FLOW OPERATION

Course Objectives:

1. Students will understand the basic concept of fluid flow, types of flow, and application of fluid mechanics.
2. Students will get the knowledge of flow and pressure measurement using different flow meters, and pressure measuring devices.
3. Students will get the knowledge of various pumps used in chemical industries.
4. Students will get the knowledge of various agitators and mixing equipments and power consumption for mixing.

Course Outcomes:

After successful completion of this course student will be able to

1. Understand the knowledge of fluid flow, fluid properties and type of fluid
2. Understand the concept of dimensional analysis
3. Select the agitators for mixing operations and able to calculate the power required for mixing.
4. Understand the concept and applications of Bernoulli’s theorem,
5. Understand the principle, working and application of different flow meter
6. Understand the principle, working and application of various pumps and able to calculate the power requirement and NPSH of centrifugal pump.
7. Calculate the pressure drop across packed bed and minimum fluidization velocity in fluidized bed; understand the concept of two phase flow.

Course Contents:

Unit I :Properties of fluid and their classification : Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids, forces on submerged bodies. rigid body motion, pressure measurement, Euler’s equation.

Unit II :Kinetics of flow, Description of velocity field, Stream functions, angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis: Buckingham Pi theorem, dimensionless number and their physical significance, simulated criteria. Mixing and agitation of fluid, types of mixers and their selection, power requirement.

Unit III :Fluid flow: Laminar and turbulent flows, pressure drop in pipes and tubes, pipe fitting and pipe network and friction factor, conversion of mass Momentum and energy, Navier-Stokes equation, mechanical energy balance and Bernoulli's theorem.

Unit IV :Flow measuring devices for chemical plants: Orifice metre, Nozzle Venturimeter, Rotameter and pitot tube.

Unit V :Pumping and compressing of chemicals and gases, reciprocating pump, rotary pump, centrifugal pump and blowers. NPSH and calibrations. Mixing and agitation fluids. Compressible fluid flow and Aerodynamics.

Unit VI :Flow past immersed bodies, flow through packed bed and fluidized bed, Introductory concept of two phase flow.

Text Books/ Reference Books :

1. R. P. Vyas, Fluid Mechanics, Central Techno Publications, Nagpur.
2. W. L. McCabe, J. C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7th Edition, McGraw-Hill International Edition 2005.
3. Chemical Engineering volume 1 coulson J. M. and Richardson J. F. Butterworth Heinemann, Oxford
4. M. White, Fluid Mechanics, 8th Edition, Tata-McGraw Hill, 2016.
5. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall of India, 2005.
6. R. W. Fox, P. J. Pritchard & A. T. McDonald, Introduction to Fluid Mechanics, 7th Edn, Wiley-India 2010.

4 FT 06 FOOD TECHNOLOGY - I –LAB

General methods of proximate analysis of food materials. Analysis of Oils and Fats, Chemical Analysis of carbohydrates and proteins, taniles vitamanies etc. colorimetric methods for starch. and qualitative detection of carbohydrates and proteins, taniles, vitamins etc. Colorimetric methods for starch, polyphenols, carotenes Xanthophylls etc. Paper chromatography and qualitative detection of carbohydrates, proteins and, tats oils, Colour. test for oil. Qualitative and quantitative analysis of acided and antioxidates. Chemical Preservations like benzoic acid and sulfur dioxide, Non-Nutritive Sweetness and emulsifying agents.

Books Recommended :

1. The Chemical Analysis of Foods, Sixth Edition by David Perason, J.O.A. Churbcill, 104 Gloucester place London. 70
2. Manual of Analysis of Fruits and Vegetable Products: S.Ranganna, Ph.D. Central Food Technological. Research Institute, Mysore, Publisher, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Food Analysis by A.G. Woodman, 4th Edition, Publishers, Mc.Graw Hill Book Company, INC, New York and London, Latest Edition.
4. Modem Food Analysis by F.Leslie Hart A.N. and Hary John Stone Fishes. Ph.D. Publishers, Springer - Verlag. Berlin Heidelberg, New York, Latest Edition.
5. Food Analysis by RLees, Published by Leonard Hill Books, London.
6. Official Methods of Analysis of Association of Official Analytical Chemists, Pub.Associ. Office, Anal, Chemist, Washington D.C. Latest Edition.
7. Approved Methods of the American Association of Cereal Chemist, Vols. I & II, Latest Edition. Published by American Association of Cereal Chemist inc. Paul, Minnesota U.S.A.

4 PT 06 PULP & PAPER TECHNOLOGY-I - LAB

Determination of various components of wood such as moisture content.ash content, Water Solubility, alkali, solubility extractives, lignin Cellulose; hemicellulose, holo cellulosepentosans etc. Microscopic observations of fibrous materials.

4 OT 06 OIL AND PAINT TECHNOLOGY-I – LAB

Preparations & Standardization Of Solutions, Determination of various Physical and Chemical characteristics of oils, fats and waxes, colour, solubility and thermal test for purity. Analysis of oilseeds and cakes, estimation of rancidity. Analysis of nickel catalysts and acid oils determination, Physical and Chemical, characteristics of vanaspati, margarine and ghee. Detection of adulteration in oils & fats Testing of readymade Paints & Raw materials of paints systems like pigments, Solvents, additives, Resins .

4 PC06 PETROCHEMICAL TECHNOLOGY- I –LAB

Course Objectives:

Petrochemical Technology lab provides students first handexperience of conducting preliminary tests for various petroleum products and verifying various standard tests and test methods setfor petroleum products and comparing and studying the standard specifications set for petroleum products.

Contents:

Experiments for Petrochemical Technology-I (Chemistry of Petroleum Hydrocarbons) such as Flash Point by Abel's Method, Flash Point by Pensky Martien's Method, Flash and Fire Point by Clevland Open Cup Method, Smoke Point, Aniline Point, Cloud and Pour Point, API Gravity, Viscosity (by Redwood Viscometer/Saybolt Viscometer/Engler Viscometer), Copper Strip Corrosion, Drop Melting Point of Wax, Melting Point of Wax by Cooling Curve Method, Congealing Point of Wax etc.

Lab. Outcomes :

Students will be able to:

- Learn how to experimentally verify various theoretical concepts.
- Visualize practical testing of petroleum products under standard test conditions.
- Develop experimental skills.

4 CT07 MACHINE DESIGN & DRAWING –LAB

Minimum 8 to 10 practicals based on the Syllabus 4 CT04 MACHINE DESIGN & DRAWING

4 CT08 MATERIAL SCIENCE & ENGINEERING – LAB

Ten experiments based on the above syllabus evenly distribute shall be performed and a report/journal there of submitted by each student. The practical Examination shall consist of practicals and viva voce based on the syllabus and practicals.

4 CT09 FLUID FLOW OPERATIONS – LAB

List of Practicals :

1. Calibration of Venturi metre
2. To obtain the coefficient of discharge for the given orifice meter
3. To study the types of flow and determine critical Reynolds number.
4. To verify Bernoulli's theorem.
5. To study the centrifugal pump
6. To study the reciprocating pump
7. To study the loss of head due to Pipe Friction
8. To study the Loss of head due to Pipe Fittings

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NOTIFICATION

No. 135 /2021 Date : 2/12/2021

Subject :- Implementation of new syllabi of Semester V & VI of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi of **V & VI** of various branches of B.E. in Civil, Mechanical, Computer Science & Engg., Computer Engg., Information Technology, Electrical Engg., Electrical (Electronics & Power) and Electrical & Electronics Engg. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
(Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

Syllabus Prescribed for V & VI Semester of B.E (Civil Engineering)

SEMESTER V

5CE01 : Design Of Reinforced & Prestressed Concrete Structures

Learning Objectives of Subject:

- To understand basic concept of limit state method.
- To understand behavior of slab under external loading.
- To understand behavior of staircase and retaining wall.
- To understand behavior of column and footing.
- To learn concept of grid slab and earthquake resistant construction.
- To introduce basic concept of prestressed concrete.

Course outcomes:

At the end of the subject the students will be able -

- To analyze and design of rectangular section.
- To analyze and design of slab.
- To analyze and design of staircase and retaining wall.
- To analyze and design of column and footing.
- To understand grid slab and ductile detailing.
- Explain the general behavior of PC sections under external load.

SECTION-A

Unit I:
1) Introduction to limit state method, basic concept and design of singly and doubly reinforced rectangular sections.
2) Analysis and design of flanged sections.

Unit II:
1) Analysis and design of one way continuous slabs
2) Analysis and design of two way slab.

Unit III:
1) Design of Dog legged staircase.
2) Design of cantilever retaining walls (Horizontal backfill only).

SECTION-B

Unit IV:
1) Analysis and design of columns for axial load, uniaxial and biaxial bending.
2) Design of isolated footings: square and rectangular subjected to axial load and uniaxial bending moment only (with uniform depth only).

Unit V:
1) Design of Grid Slab by I.S. code method.
2) Detailing for earthquake resistant construction. Introduction, Cyclic behavior of concrete and reinforcement, significance of Ductility, Ductile detailing for beams, columns, beam-column joint and footing.

Unit VI: 1. Introduction to Prestressed concrete: Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses of prestress.
2. Analysis of Rectangular and flanged beams.

Notes:
1) Students should use IS 456:2000, IS 1343:2012, IS 1893:2016, IS 13920:2016.
2) Field visit on any RCC framed structure & report of the same.
3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:
1. Ashok K Jain : Reinforced Concrete Limit state Design (Nem Chand & Bros Roorkee)
2. S.K.Sinha: Reinforced Concrete Design (M C Graw Hill Education India Pvt Ltd)
3. Devdas Menon, S. UnnikrishnaPillai :Reinforced concrete Design ;Third Edition; McGraw Hill Education
4. Dr.Shah V.L. &Karve S.R. : Limit State Theory & designof Reinforced concrete IS 456:2000(Structurs Publication)
5. Neelam Sharma :Reinforced Cement Concrete design (S.K.Kataria& Sons)
6. S.S.Bhavikatti :Design of R.C.C. Structural Element (R.C.C. Vol. I)(New Age International Publishers)
7. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
8. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi

5CE02: SURVEYING & GEOMATICS

Learning Objectives of Subject:
- To prepare the student to understand applications of curves.
- To enable the students to establish accurate control for photogrammetric survey and to determine accurate locations of points in engineering works
- To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
- To develop the skills in surveying and thematic mapping.

Course Outcomes:
At the end of the course students will be able to
- Understand the use of different types of curves and their field implications.
- Understand the triangulation adjustment.
- Understand the hydrographic survey.
- Acquire skills in handling spatial data base warehousing and mining.
- Understand the surveying with advance instrument like remote sensing, GPS and GIS.

SECTION- A

Unit-I: Curves: Classification, degree of curve, elements of circular and compound curves, theory and methods of setting out simple curves, Instrumental method of setting out compound curves.

Unit-II: Triangulation: principles, classification of triangulation system, triangulation figures, their choice of station, phase of signals, towers, satellite station, reduction to center, field work, reconnaissance, Inter-visibility, angular measurements. Basenet, extension of Basenet.

Unit-III: Hydrographic surveying: necessity, controls, shore line surveys, gauges, sounding equipmentés and procedure of taking soundings, methods of location of sounding, three-point problem in hydrographic surveying, analytical and graphical methods. Underground Surveying: surface alignment, correlation of surface and underground surveys; Weisbach triangle, transferring levels and alignment underground.

SECTION – B

Unit-IV: Elements of photogrammetry: Basic definitions, terrestrial and aerial photography, scale of vertical photograph, Relief and relief displacements, heights from parallel measurements, flight planning, photographs required.

Unit-V:1.Remote sensing: Introduction, definitions, remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics 2. GPS: Global positioning system (GPS) introduction, definitions, GPS receivers, antenna, advantages of GPS.

Unit-VI: 1. Geographical Information System: Definition and history, Components of GIS, Data structure and formats, Spatial data models ï Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Introduction to QGIS software. 2. GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning.

Books Recommended:
1. D. Clark.: Plane and Geodetic Surveying Vol II, CBS Publishers & Distributors Pvt. Ltd,
2.T.P. Kanetkar & S.V.Kulkarni: Surveying and Leveling Part II, Pune Vidyapetth GrahaPrakashan.
3. B.C.Punmia: Surveying Vol. II and III, Tata McGraw-Hill Publishing Company Limited,
4. Kang-tsung Chang: Introduction to Geographic Information Systems, McGraw-Hill Book Company, 2006.
5. B.C. Punmia, Ashok Jain, Arun k. Jain: Higher surveying, Laxmi publications (P), Ltd,
6. Dr. S. Kumar: Basics of remote sensing and GIS, Laxmi publications (P), Ltd

5CE03: NUMERICAL METHODS AND COMPUTER PROGRAMMING

Learning Objectives of Subject:
- To learn the basics of spreadsheets.
- To learn the basic concepts of computing.
- To know the methodology of problem solving.
- To develop skills in programming using C language.

Course outcomes:

At the end of subject the students will able -

- To use spreadsheet software for solving civil engineering problems.
- To impart knowledge to analyze, solve, design and code numerical method problems using C language.
- To impart knowledge to analyze, solve, design and code civil engineering problems using C language.

SECTION – A

Unit-I:
Spreadsheet software basics, Expressions, Mathematical Functions, Conditional Execution Functions like IF, COUNT, COUNTIF, SUM, SUMIF, AVERAGE, AVERAGEIF, LOOKUP, HLOOKUP. Application to the Civil Engineering Problems.

Unit-II:
1. Basic structure of C program, use of library functions, input output statements, flowchart.
2. Decision Control structures and loop Control structures conditional loop and unconditional loop: WHILE, DOWHILE, FOR, IF, IFELSE, NESTEDIF, LADDER IFELSE etc.

Unit-III :
1. Type casting, single dimensional and multi-dimensional array, subscripted variables
2. Functions in C

SECTION-B

Computer Programming using C:

Unit-IV:
1. Matrix operations such as:
   a. Addition and subtraction
   b. Multiplication
   c. Transpose
   d. Testing summary etc.
2. Fourth order, Runge - Kutta method for solution of first order, second order differential equations and two simultaneous equations.

Unit-V:
1. Solution of quadratic equation
2. Numerical integral using Trapezoidal and Simpson rule
3. Finding root of equation f (x) = 0 by Newton ï Raphson , Regula -Falsi and Bisection method.

Unit VI:
1. Centre of gravity, moment of inertia & radius of gyration of Tee section.
2. Bending moment and shear force ordinates for simply supported beam subjected to point and uniformly distributed load only.
3. Design of singly reinforced beam by limit state method.
4. Determination of coefficient of permeability in parallel and perpendicular direction of bedding plane
5. Reduce level by height of instrument method.
6. Determination of Chezyôs constant.

BOOKS RECOMMENDED :

1.E Balagurusamy, Programming in ANSI C
2.Yashavant P. Kanetkar, Let Us C
3. Pradeep Dey & Manas Ghosh ñComputer Fundamentals &Programming in Cò Oxford University Press 2006.
4. Herbert Schildt - C Complete Reference (Tata-McGraw Hill)
5. Gottfried ï Problem Solving in C (Schaum Outline Series- McGrawHill)
6. Noel Kalicharan - C by Example (Cambridge University Press)

5CE04 : (PROFFESSINAL ELECTIVE - I) (I) HIGHWAY CONSTRUCTION AND MANAGEMENT

Learning Objectives of Subject:

- To know the development of transport, various road development plans and policies in India and test procedures for highway materials.
- To understand the principles of highway geometric design as per IRC standards.
- To study the different types of pavement its construction, maintenance & design by different methods.
- To understand the Traffic engineering & different types of traffic control devices.
- To study the causes, preventions, better planning & design of highway to prevent accidents.
- To study various types of equipments, their working principles & limitations for flexible and rigid pavement.

Course outcomes:

At the end of the subject the students will be able ï

- Explain the basic concepts about highway engineering
- To design geometric elements of the highway.
- To design the various types of road pavements with construction and maintenance of highway.
- To carry out traffic studies and implement traffic regulation and control measures and intersection design.
- To apply the knowledge to prevent the road accidents.

SECTION A

Unit I: Highway: Development and Planning, Road Transport characteristics, classification of Roads, Road development plans & Salient features, Road pattern, Alignment principles, Egg. Survey for highway. Material and Testing. Various properties of aggregates and bituminous materials and Test, IRC, IS Specifications, bituminous mix design.

Unit II: Geometric Design : cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, Overtaking sight distance, Horizontal alignment - curves, super elevation, Extra widening, transition curves, vertical alignment, Design of summit and valley curves, IRC Standards for Geometric design.

Unit III: Pavement Design: Components of Flexible and Rigid pavement, Design factors, ESWL, Flexible pavement design by C.B.R. Method. Westergards analysis for wheel load & Temperature stresses in rigid pavement, Rigid pavement by IRC method (As per IRC-37), Combination of stresses, Joints in Rigid Pavement, Construction And Maintenance ï WBM Surface dressing, Bituminous roads, cement concrete Pavement, construction procedure, construction of roads in expansive soil .

SECTION B

Unit IV: Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design; redesign of existing signal including case studies. Signal system and co-ordination. Evaluation and design of road lighting.

Unit V: Road Safety: Road accidents, Causes, scientific investigations and data collection. Safety in Road Design ï Accident prevention through better planning and design of roads ï planning road networks by land use planning. Traffic calming techniques and innovative ideas in road safety.

Unit VI: Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

Books Recommended:

1. Kadiyali L.R., ñ Principles & Practice of Highway Engineeringò Khanna Publisher
2. ñHighway Engineeringò, Khanna & Justo, (Nem Chand & Poros, Roorkee.1997)
3. E.J. Yoder, ñPrinciples of Pavement Design,ò John Wiley & Sons lnc., New York
4. Chakroborty P Das ñPrinciples & Practice of Highway Engineeringò (Khanna Publisher 2000)

REFERENCE BOOKS:

1. Highway Material Testing ï S K Khanna- C.E.G. Justo, Nemchand Bros- Rookee, 2000
2. S.K.Khanna & Justo C.E.G., Highway Material Testing Manual
3. A.K. Duggal and Vijay P.Puri, ñLaboratory Manual in Highway Engineering,ò.

5CE04: (II) REPAIRS & REHABILITATION OF STRUCTURES

Learning Objectives of Subject:

- To learn various distress and damages to concrete and masonry structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To assess the damage to structures using various tests
- To learn the importance and methods of substrate preparation
- To learn various repair techniques of damaged structures, corroded structures

Course outcomes

At the end of the subject the students will be able ï

- Various distress and damages to concrete and masonry structures
- The importance of maintenance of structures, types and properties of repair materials etc
- Assessing damage to structures and various repair techniques

SECTION A

Unit I : Introduction: General Consideration, Distresses monitoring, Causes of distresses, Quality assurance, Defects due to climate, chemicals, wear and erosion, inspection, Structural appraisal, Economic appraisal Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure.

Unit II: Structural health monitoring, various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion, fire safety.

Unit III : Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations of investigator, tools for investigation, Various NDT Methods for assessing strength of distressed materials, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.

SECTION B

Unit IV: Retrofitting of Structures, parameters for assessment of restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration, and various techniques of retrofitting. Waterproofing of RCC water retaining structures.

Unit V: Safety during construction, formwork and staging, material handling, Existing methods of formwork, Modular formwork, Structural aspects for formwork in buildings & bridges.

Unit VI: Demolition of Structure, study of structural system and structural drawings, need and importance for demolition, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials

Books Recommended:

1. Deananmmer: õHandbook of Material Managementö, McGraw Hills.
2. Gopalkrishnan: õFundamentals of Material Managementö, Tata McGraw Hills.
3. M Y Khan and Jain: õFinancial Managementö, Tata McGraw Hills
4. A M Neville: õProperties of Concreteö, Longman
5. R N. Raikar: õDurable Structuresö, R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
6. R.N. Raikar: õLearning from Failuresö, R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
7. R.N. Raikar: õDiagnosis and treatment of structures in Distressö, R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
8. Hanbook on Seismic Retrofit of building , Central public works Department & Indian Building Congress In Association with IIT - Madras

5CE04 : (III) SUSTAINABLE CONSTRUCTION METHODS

SECTION A

Learning Objectives of Subject:

- Student should learn about the present demand supply gap of various construction resources and resource forecasting.
- Student should be able to understand various pollutions and its impact, rules and regulation related to pollution control.
- Student should be able to understand the concept of Sustainability , strategy to achieve it .
- Student should turn aware about various organizations working for implementing sustainability, Green rating agency and process to achieve it.
- Student should be able to determine use of waste material by proper process and percentage.
- Student should learn about sustainable construction like ó Green roofs, Green walls etc.
- Student should be able to understand thermo resistive property of construction material and its effect on utilization.
- Student should learn about sustainable Illumination, ventilation techniques.
- Student should know to manage domestic water resources.

Course outcomes:

At the end of the subject the students will be able -

- To understand present condition and need for replacement of non renewable resources.
- To understand concept of sustainability and strategy to achieve it.
- To understand various criteriaøs and considerations to achieve sustainable construction according to Green Rating Agencies.
- To decide application of sustainable methods in construction for Roof, Wall, thermo resistivity etc.
- To reduce water need and reuse of house hold waste water.

SECTION A

Unit I: Role of Construction sector in Global Resource Consumption, Resource like sand , water , aggregates , cement etc. demand supply gap analysis. Construction & Demolition waste. Environmental pollution related terms like Global warming, Carbon credit, Resource exploitation, Land pollution, Urban Heat Island, Air and water Pollution. Rules and Act related to waste management and pollution mitigation.

Unit II: Concept of Sustainability, Its origin, Legislation related to Sustainable construction , Reduce ó Reuse ó Recycle (3 R) Strategy , Various Green Rating Agency worldwide, Detail study of criteriaøs and process under GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council), LEED, India (Leadership in Energy and Environmental Design).

Unit III: Concept of Manufacturing cost, operational cost and life time cost, Payback Period. Thermo resistive property of construction materials and its importance. Implementation of Waste and recycled materials in construction ó Case study of some projects like Use of Plastic in Road construction, recycled aggregate utilization and similar to this. Various types of Renewable Energy and its application.

SECTION B

Unit IV: Concept of Green/ Sustainable Roofs, Its types, geometry, material, methodology and Limitations. Concept, material & methodology and limitation of Green walls, various methods like implementation of Cavity wall, Rattrap bond wall, thermo resistive material wall, Green vegetative wall etc.

Unit V: Sick Room, Need and types of windows & ventilations, active and passive ventilation concept, Role of opening location and dimension in Ventilation and air circulation. Sustainable ventilation techniques.

Unit VI: Illumination terms :- Glare , Glare Index ,dark room, comfortable illumination , Lux value for various rooms as per utilization as in latest Building Code of India , Role of Solar direction, season and location for direction and provision of openings. Sustainable Illumination Techniques (Natural & Artificial methods) ,
Water Management – Re Use of domestic water, Grey water ï Concept and some Grey water treatment units example, Ground water recharging techniques, Rain water harvesting.

Books Recommended:

1. Moore F: Environmental Control System McGraw Hill, Inc., 1994.
2. K S Jagadish, B V Venkataramana Reddy, K. S. NanjundaRao : Alternative Buildings Materials and Technologies, New Age International Publishers, New Delhi, 2007
3. "Construction Materials, Methods & techniques" (3e) by William P Spence, Yesdee Publication 2012, pvt.ltd, Chennai, India
4. "Concrete Structure Properties & Materials" by mehataP.K&MantreioP.J.M, Prentice hall.
5. "Building Materials" ny M. L. Gambhir, NeaJamwal, Tata McGraw Hill Publication.
6. Building Reuse ,Sustainability preservation and value of life by Kathrin Rogers Mrilino.
7. Sustainable Construction Engineering & Management by Dr. S.K.Deshmukh & Dr. Abhinandan R.Gupta, LAP academic Publishing Mauritius
8. Energy Efficient Construction Materials, Key Engineering Material, Elsevier by Dr. S.K. Deshmukh & Dr. Abhinandan R.Gupta
9. Handbook of GRIHA for Green Rating
10. Handbook of LEED , India for Green Rating.

5CE04 :(IV) WATERSHED ENGINEERING AND MANAGEMENT

Learning Objectives of Subject:

- To study the different hydrological parameters.
- To understand hydrological statistics and design.
- To characterize and mitigate natural and man-made hazards.

Course Outcome: Student shall be able to

- Explain the hydrology and hydrological data.
- Analyze the hydrological methods for runoff.
- Evaluate the ground water hydrological problems.

SECTION - A

UNIT I: Introduction: Watershed, Definitions, Concept of watershed development, objectives of watershed development, and need for watershed development, Integrated and multidisciplinary approach for watershed management.
UNIT-II: Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.
UNIT-III: Hydrology in water resources development, statistical analysis of rainfall and runoff, different distributions methods, Estimation of Unit Hydrograph-flood flow formulae, Storm hydrograph, Storage and regulation of runoff-safe yield of streams

SECTION - B

UNIT-IV: Hydrology of ground water : Common aquifers-Exploration for ground water, hydraulics of ground water flow- Measurement of permeability of formations, flow nets and their constructions, Boundary conditions ï Unconfined and Confined, steady and unsteady flow into wells, Method of images ï Types, design, construction and maintenance of wells and infiltration galleries, Development of wells ï well strainer ï functions and selections, Ground water recharge
UNIT-V: Practice of watershed management: rehabilitation, protection and enhancement, non-point sources of pollution: the legal basis, the process of non point source pollution control, best management practices principles, Applications of Geographical Information System and Remote Sensing in Watershed Management
UNIT-VI: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation. Drought assessment and classification, drought analysis techniques, drought mitigation planning. Water conservation by recycle and reuse .

Books Recommended:

1. Watershed Hydrology by Peter E. Black.
2. Water Resources Systems, Planning and Management by R. N. Chaturvedi.

5CE05 (OPEN ELECTIVE) (I) BASICS OF BUILDING CONSTRUCTION

Learning Objectives of Subject:

- To understand the basic concepts of structures and types of foundation of civil structure.
- To learn about the different type of masonry, types of bonds and construction methodology.
- To understand various levels in building ï Types of floorings and floors,
- To understand the type and need of openings for access and circulation.
- To make aware of knowledge and importance of stairs, plastering and painting of structures.
- To understand the aspects of construction.

Course outcomes:

At the end of the subject the students will be able -

- To understand Load bearing and Frame structure with their foundations.
- To recognize various types of construction material and its suitability
- To recognize the various levels in building and its need.
- To know types of openings, doors, windows and other related fixtures.
- To recognize types of rock and minerals and its construction properties.
- To understand the basic concepts of DPC, fireproof, soundproof and expansion joints in structure.

SECTION –A

Unit I: Introduction: Definition of building as per national building code, components of buildings and their function , Types of structure-load bearing structure and frame structures, their relative advantages and disadvantages, load bearing walls and partition walls. Types of foundation- Definition and necessity and types of foundations, precautions to be taken against failure of foundations

Unit II: Stone Masonry- Technical term, general principles to be observed during construction, selection of stone masonry. Brick Masonry Construction- Technical term, general principles to be observed during construction, commonly used types of bonds such as Stretcher, Header, English bond Flemish bond and their suitability.

Unit III: Floors- Types of floors-Basement floor, ground floor and upper floor. Types of upper floors-R.C.C. slab floor, R.C.C. slab and beam floor, R.C.C. grid floor, R.C.C. flat slab floor. Floor Finishes Types of flooring material, Shahabad , Kota, Granite, Ceramic tiles, Plain tiles, mosaic tiles glazed tiles ,different types of floor finishes , their suitability. Method of construction, criteria of selection. Roofs-Flat and pitched roof, steel roof trusses-types and suitability ,fixing details at supports ,types of roof covering, AC and GI sheets, acrylic sheets, fixing details of roof covering.

SECTION –B

Unit IV: Door ï Purpose, criteria for location, size of door, door frames and its types, method of fixing Windows- Purpose, criteria for location, size and shapes of windows, types of windows and their suitability. Ventilators ï Types and their suitability. Fixtures and Fastening for doors and windows. Glass- Types of glass and their suitability. Arches and Lintels - Types and their suitability. Details of R.C.C. lintels and chajja, precast lintels and arches.

Unit V: Stairs- Function, technical terms, criteria for location, types of staircases and their suitability. Painting and Coloring ï Necessity, types, processes of painting and coloring to the wall surface, wooden surfaces, iron and steel surfaces, types of paints and their uses Scaffolding- Purposes, types, suitability.

Unit VI: Special Aspects of Construction, Damp proofing-causes of dampness, its effects, various methods of damp proofing, material used for damp proofing. Fire proof construction- Points to be observed during planning and construction. Fire protection requirement for a multistoried building, Sound proof construction ï Sound absorbents and their characteristic. Joints Expansion and construction joints necessity, details of expansion joint at foundation level and roof level of load bearing structure and framed structure, Provision of construction joints in slabs, beams and columns.

Books Recommended:

1. Deshpande R.S... And Vartak C.V.: A Treatise on Building Construction.
2. Sharma S.K. Kaul and B.K.:A.T.B. Building Construction, S Chand and co.
3. Sane L.S.: Construction Engineering, Manak Talas, Mumbai
4. Chudley R.: Construction Technology, Volume I.II.III. And IV, Longmans Group Ltd.
5. Basics of Civil Engineering, Vol. I by Dr A.R.Gupta , Google book publishers ltd.
6. Gurucharan Sing: Building Construction Engineering, Standard Book House, Delhi-06
7. Sushilkumar :Building construction ,Standard publisher distributors.
8. B.C.Punmia ,A.K. Jain,: Building construction. ISE National Building code of India, 1970

5CE05 : (II) DISASTER MANAGEMENT

Learning Objectives of Subject:

- Student should learn about the term Disaster and definitions associated with it.
- Student should know various types , reasons for happening and preventive measures for Natural Disasters .
- Student should know various types , reasons for happening and preventive measures for Artificial Disasters
- Student should know about Impact and mitigation measures against disasters.
- Student should know about Disaster Risk Reduction and its utility practices.
- Learner should know about various Government and NG organization working for Disaster Management.
- Student should know role and responsibility of individual and group for managing Disaster.

Course outcomes:

At the end of the subject the students will be able -

- To understand concept and terms related to Disaster.
- To understand various types of Natural and Artificial Disaster .
- To decide and take actions to mitigate impact of disaster.
- To know roles and responsibility of organizations ï public and private, individual and group to manage disaster.

SECTION A

Unit I: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation. Study about natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.);

Unit II: Study about manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit III: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

SECTION B

Unit IV: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures, vulnerability and capacity assessment; early warning systems, Post disaster environmental response.

Unit V: Institutional mechanism for Disaster Management**,** Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, Disaster Management Policy Environment and local Action, Funding for Disaster Management, Capacity Building, Disaster Management Act 2005.

Unit VI:. Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster, plan to counter, threats to water supply.

Books Recommended:

1. Cuny, Fred C; Disasters and management, oxford Uni. Press.
2. Alexander, David; Principles of emergency planning and management, Terra publishing, ISBN 1-903544-10-
3. National Disaster Management Authority, Govt. of India, Report.
4. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994

5CE05 :(III) SOFT SKILLS AND INTERPERSONAL COMMUNICATION

Learning Objectives of Subject:

- Student should learn about the methods and measures to develop the interaction skills.
- Student should be able to have strong decision making and lateral thinking skills.
- Should know the do's and don'ts for being good leader.
- Should be able to understand about conflict and be able to manage it.
- Should understand need of Negotiation and strategy to handle it wisely.
- Should be able to recognize the type, ways and barriers in Communication so as to develop it.
- Should be able to conduct effective correspondence process and shall have knowledge of documentation and formal writing skills.

Course outcomes:

At the end of the subject the students will be able -

- Interact in developed way so as to handle the situations .
- To take analyzed decisions over the problem and will effectively carry out wok in time.
- To handle task with developed leadership skills.
- To determine the reasons and solutions over conflict and will be able to manage it.
- To understand need for negotiation and strategy negotiate things.
- To have strong communication.
- To carry out formal documentation process and will have proper guideline for writing formal basic documents.

SECTION A

Unit I : Individual's Basic Interaction Skills – Within family, Society Personal and interpersonal intrapersonal skills . Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking. Self Awareness and Self Esteem Group Influence on Interaction Skills Human relations examples through role – play and cases.

Unit II : Leadership Skills Working individually and in a team Leadership skills Leadership Lessons through Literature Team work & Team building . Interpersonal skills – Conversation, Feedback, Feed forward Interpersonal skills – Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team – work. Conflict Management – Types of conflicts, how to cope with them Small cases including role – plays will be used as teaching methodology.

Unit III : Negotiation Skills (To be Taught through Role Plays and Cases) Types of Negotiation Negotiation Strategies Selling skills – Selling to customers Selling to Superiors Selling to peer groups, team mates & subordinates Conceptual selling, Strategic selling Selling skills – Body language

SECTION B

Unit IV : Introduction, Need for Communication, Process of Communication - Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication - Inter-cultural, Intra-cultural, Cross-cultural and International communication - Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Unit V : Barriers to Communication Improving Communication Skills -Preparation of Promotional Material -Non-verbal communication -Body language -Postures and gestures -Value of time -Organizational body language -Importance of Listening -Emotional Intelligence.

Unit VI : -Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos - Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids .

Book Recommended:

1. Personality Development & Soft Skills by Barun K. Mitra.
2. Soft Skills and Interpersonal Communication by S. Balsubhramanium.

5CE06 : DESIGN OF REINFORCED & PRESTRESSED CONCRETE STRUCTURES - LAB

Practicals:
1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any RCC framed structure & report of the same.

5CE07: SURVEYING & GEOMATICS – LAB

Following is the list of practical to be conducted. Minimum 8 practical out of the given should be carried out. Practical examination shall consist of field exercise and viva-voce examination based on theory & practical.

List of Practicals: (Any Eight)

1. Ranging circular curve by offset from long chord.
2. Ranging circular curve by offset from tangent.
3. Ranging circular curve by offset from chord produced.
4. Ranging circular curve by Rankineǿs method.
5. Triangulation by satellite station.
6. Base line measurement in triangulation system.
7. To Find horizontal distance and difference in elevation between two points by using Total station.
8. To plot a layout using Total station.
9. Study on Stereoscope.
10. Application of GPS ї Distance and Coordinate Measurement using GPS tool.

5CE08 : NUMERICAL METHODS AND COMPUTER PROGRAMMING -LAB

Practicals: Preparation and execution of at least **six** computer programs using C language. Solution of at least **two** civil engineering problems using spreadsheet software. A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

5CE09 : (I) HIGHWAY CONSTRUCTION AND MANAGEMENT –LAB.

List of Practicals :-

Any **Five** of the following should be conducted and a report there of should be submitted:
1. Field CBR Test.
2. Pavement Evaluation by Benkelman Beam Method.
3. Road Unevenness Measurement by Bump-Integrator.
4. Valuation of Pavement Roughness by Roughometer / Profilometer.
5. Design of Flexible Pavements for Highway.
6. Design of Flexible Pavements for Runway.
7. Design of Rigid Pavements For Highway.
8 . Design of Rigid Pavements For Runway
9. Design of Overlays.
10. Marshal Stability Test
11. Transportation management (**field studies)**
12. Parking management (**field studies)**
13. Road accident studies (**field studies)**
14. Rotary design

Field Visit:

1. Hot ї mix plant visit,
2. Road construction site visit: Earth work construction procedure and bituminous mix laying, spreading and rolling procedure.

5CE09 :(II) REPAIRS & REHABILITATION OF STRUCTURES – LAB

List of Experiments: (Any Three)

1. To perform a non-destructive and semi-destructive testing on the cast specimens of the beams using set up of Rebound hammer, UPSV, Core drilling etc. and there by prepare a report on the interpretation of the strength i.e quality of concrete based on NDT test results.
2. Take up Conditional Assessment of 5 different structures including Residential, Commercial, Industrial, and Government buildings, Private structures (old & new construction both). Prepare Rapid visual inspection data sheets of the same.
3. Prepare a report of the buildings surveyed, to highlight all the defects/deterioration seen through proper resolution photographs. The report must clearly indicate the distress ï its source and symptoms.
4. Perform experiment to evaluate the Compatibility between the substrate material concrete and any repair material. (For instance comparing the Bond strength of Polymer modified mortar and Conventional Mortar with Concrete).
5. Experimental investigation to carry out the efficacy of repair material/ technique of enhancing the strength of concrete beam post cracking. (For instance, Cast a RCC beam, simulate cracking and then filling the crack with repair material and check the post-repair strength results).

Major Equipment: Compression Testing Machine, Concrete Mixture, NDT equipment like USPV, Rebound Hammer, Corrosion Meter, Rebar Locator, Engineerọs inspection Kit.

5CE09 : (III) SUSTAINABLE CONSTRUCTION METHODS – LAB.

1. Experimentation to check the corresponding strength of material by mixing waste material for Concrete work : Casting of 2 sets of specimen only with each set of 3 cubes , for percentage replacement of concrete elements with any suitable waste material like ï Recycled aggregate, waste vehicle tire etc.
2. Experimentation to check the corresponding strength of material by mixing waste material for Brick work : Study of cavity wall and rattrap wall for thermo resistive property.
3. Student can work out and prepare report on installation plan , process ,budget, payback period and maintenance required for renewable energy source like solar / wind for small residential house of around 5 rooms.
4. Study and Preparation of Isolux mapping for room using Lux meter, for understanding illumination area and pattern.
5. Case Study : Students should visit to nearby sustainable construction like old existing monumental structure like Palace, religious place, well , fort **or** any Green rated structure by valid Rating agency like GRIHA , LEED India etc. **or** any undergoing sustainable project in vicinity for better understanding and needs to prepare the short report over learningọs.

5CE09:(iv) Watershed Engineering And Management – Lab.

Minimum 8 practicalọs out of the given should be performed. The Site visit is compulsory. The Graphs and sheets are to be drawn whenever are necessary. The practical examination shall consist of viva-voce based on theory and Practical.

List of Experiments:

1. Study of watershed management technologies.
2. Watershed planning and development.
3. Surveying and preparation of watershed map.
4. Analysis of hydrologic data for planning of watershed development.
5. Water budgeting of watersheds.
6. Grid survey of watershed area.
7. Study of Aquifer (Working, Types, Flow net)
8. Study of infiltration galleries. (Types, Design, Construction, Maintenance)
9. Study of unit hydrograph, Storm hydrograph
10. Design of storm water drainage system.
11. Visit to watershed development project.

SEMESTER SIXTH

6CE01: DESIGN OF STEEL STRUCTURES

Learning Objectives of Subject:

- To introduce steel structures and its basic components
- To understand methods of design of steel structure.
- To introduce structural steel fasteners like welding and bolting
- To introduce design method of tension & compression members.
- To introduce design method of beams, Column, Base Plate.
- To introduce design load on a typical steel roof trusses.

Course outcomes:

At the end of the subject the students will be able -

- To explain the methods of design of steel structure.
- To design bolted and welded connection.
- To identify the different failure modes of bolted and welded connections, and determine their design strengths.
- To design the Tension and compression member.
- To identify and compute the design loads on a typical steel roof trusses.
- To design basic elements of steel structure like beams, column and bases.

(By Limit State Method IS 800:2007)

SECTION – A

Unit I:

- Introduction to WSM, LSM & Plastic analysis of steel structure, plastic hinge, plastic moment capacity, shape factor, plastic section modulus.
- Design of bolted & welded connections subjected to axial and eccentric loading (In the plane of group of Bolts & Weld).

Unit II:

- Design of Compression & Tension member.
- Design of Industrial shed.

SECTION – B

Unit III:

- Design of simple & compound columns for axial loading.
- Design of column bases (Slab base & Gusseted base) subjected to axial load.

Unit IV:

- Design of simple Beams (laterally supported).
- Design of compound Beams (laterally supported).

Books Recommended:

1. Duggal, S. K., Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
2. N. Subrramanyam, Design of Steel Structures, Oxford University Press, 2008.
3. V L Shah & Veena Gore: Limit State Design of steel structures IS 800-2007
4. M. R. Shiyekar, Limit state design in Structural Steel (Second Edition); PHI Learning Pvt. Ltd.
5. Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800 ï 2007; I K International Publishing House Pvt. Ltd.
6. M. L. Gambhir, Fundamentals of Structural Steel Design ; McGraw Hill Education.

6CE02: ENVIRONMENTAL ENGINEERING – I

Learning Objectives of Subject:

- To make the students conversant with sources and its demand of water
- To understand the basic characteristics of water and its determination
- To expose the students to understand the design of water supply lines
- To provide adequate knowledge about the water treatment processes and its design
- To have adequate knowledge on operation and maintenance of water supply

Course Outcomes: -

At the end of the subject the students will be able -

- Define and explain the significance of terms and parameters frequently used in water supply engineering.
- Evaluate the influence of the different parameter in design and treatment of water treatment plant (water quality parameters).
- Basic methodology for water treatment (viz., sedimentation, coagulation, flocculation, filtration, disinfection and water softening.)
- An understanding of water quality criteria and standards, and their relation to public health.

SECTION – A

Unit-I : Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire Demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population.
Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.

Unit-II :Water quality: Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works. Intakes- type, location, requirement & features.

Unit-III: Aeration: Purpose, types of gravity aerators & spray aerators.
Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems on design of sedimentation tanks.

SECTION – B

Unit-IV: Filtration: - Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters.

Unit V: Disinfection: - Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination, forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments-Softening and Defloridation.

Unit-VI: Distribution system: - Types of supply: Continuous, and intermittent. Types of system: Gravity, Pumping and combined gravity and pumping, Layouts of distributions system. Maintenance of distribution system. Equalizing storage, Type of storage reservoirs, capacity. Types of conduits, joints, appurtenances. Pipe laying and testing.

Books Recommended:
1. Steel E. W., ñWater Supply and Sewerageò, Mc-Graw Hill.
2. Kshirsagar S. R., ñWater Supply Engineeringò, Roorkee Pub house, Roorkee.
3. Birde G. S. , ñWater Supply and Sanitary Engineeringò, Dhanpat Rai and Sons, Delhi.
4. Punmia B. C. ñwater Supply Engineeringò. Laxmi publication.
5. Garg S.K. Water Supply Engineering, Khanna Publishers.

6CE03: FLUID MECHANICS

Learning Objectives of Subject:
1. To study the basic behavior of fluids and fluid system and the laws governing this behavior
2. To understand and apply the basic concepts Mechanics to carry out professional engineering activities in the field of fluids.
3. To apply scientific strategies to analyze qualitatively and quantitatively the problems and give solutions.

Course Outcomes:
At the end of the subject the students will be able -
1. Describe basic properties of fluid flow.
2. Apply the knowledge to fluid flow problems.
3. Analyze the type of flow by using basic of mathematical principle.
4. Solve and modeling the pipe flow problems.

SECTION - A

Unit I: Properties of fluids: Introduction, properties of fluids, viscosity, surface tension, & capillarity, related problems. Pressure and its measurement: Fluid pressure at a point, Pascalôs Law, pressure variation in a fluid at rest, absolute gauge, atmospheric & vacuum pressures, measurement of pressure, simple manometers, differential manometers, related problems.

Unit II: Hydrostatic forces on surfaces: Introduction, total pressure & centre of pressure, vertical, horizontal plane surface submerged in liquid, related problems.
Buoyancy & floatation**:** Introduction, buoyancy, centre of buoyancy, metacentre, metacentric height, analytical method of metacentric height, conditions of equilibrium of a floating & submerged bodies, related problems.

Unit III: Kinematics of flow :Introduction, methods of describing fluid motion, types of fluid flows, continuity equation in three dimensions, velocity & acceleration, velocity potential function & stream function, related problems.
Dynamics of fluid flow: Introduction equation of motion, Eulerôs equation of motion, Bernoulliôs equation from Eulerôs equation, its assumptions, related problems.

SECTION - B

Unit IV: Measurement of fluid flow, Horizontal venturimeter, V and Rectangular Notches, Darcyôs equation (no proof), major and minor losses in pipes, pipes in series and parallel, pipe network. Momentum equation and its application to horizontal pipe bends.

Unit V: Dimensional Analysis; Buckinghamôs Pie theorem, itôs application, similitude, Dimensionless numbers, Re, Fr, We, Predominant forces & their ratio, Model Analysis - Geometrically similar models, Reynolds law, Froudes law, Model study of spillways.

Unit VI: Uniform flow, Open channel flow, Types of flow, geometric elements of rectangular & trapezoidal sections, Chezyôs &Mannings equations, most efficient rectangular & trapezoidal section, Energy & momentum principles, Normal & critical depth, specific energy diagram, discharge diagram.

Books Recommended:
1) Modi P.N. & Seth S.M.: Hydraulics & Fluid Mechanics, SI Edition, Standard book house.
2) Dr. Jain A.K.: Fluid Mechanics, Khanna publication.
3) Subramanya K.: Fluid Mechanics, Tata Mc-Graw Hill.
4) Streeter: Fluid Mechanics, Mc-Graw Hill.
5) Fluid mechanics by R.K.Bansal, Laxmi publication.
6) Garde&Mirajgaonkar: Fluid Mechanics, Scitech publication.

6CE04: PROFESSIONAL ELECTIVE – II (I) ADVANCED CONSTRUCTION MATERIALS

Learning Objectives of Subject:
- To understand the special type of concrete and supplementary cementatious materials.
- To learn about the different type of metals and new alloy steels.
- To learn different composite materials and Thermal and Sound insulating materials.
- To understand different types of construction chemicals and wastes.
- To learn different types of shoring and formwork materials.
- To understand the concept of smart materials.

Course outcomes:
At the end of the subject the students will be able -
- To understand special type of concrete and supplementary cementitious materials.
- To recognize various types of metals and new alloy steels.
- To understand Thermal and Sound insulating materials.
- To know types of construction chemicals and wastes.
- To recognize types of shoring and formwork materials.
- To understand the elementary concept of smart materials.

SECTION A

UNIT I: Cement, Mortar And Concrete Ceramic Materials
Study of Special Purpose Cement, Mortar, Concrete - High Strength And High Performance Concrete, Self Compacting Concrete, supplementary cementitious material - Fly Ash, Red Mud, Gypsum, Various Types of Finishes & Treatments, Engineering Grouts, Mortar plaster, Gypsum, Glass. GGBS, micro silica etc. Replacement of aggregates; stone dust, light weight aggregates, recycled aggregate.

UNIT II: Metals
Steels - HYSD, TMT, Tendons, Light Gauge Steel, Steel Fastenings, New Alloy Steels ï Aluminum and Its Products, Protective Coatings to Reinforcement.

UNIT III: Composites
Polymer and its composites, Ceramic and its composite, FRC, Ferro cement etc., Timber, bamboo, veneer, Laminates, Particle boards, Thermal and Sound insulating materials.

SECTION B

UNIT IV: Construction Chemicals and Waste: Chemical Admixtures and Adhesives, Water Proofing Compounds ï Non Weathering Materials, GeoSynthetics, Geo-Membranes,, Asphalt, Tar & Bituminous Materials, Agro Waste Materials, Industrial Waste Materials, Disposable Materials.

UNIT V: Shoring & Formwork Materials : Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Plywood -Types and grades, Reconstituted wood -Steel -Aluminum Form lining materials, Design Considerations, Building and Erecting the formwork, Causes of Failure of Formwork.

UNIT VI: Elementary Concept Of Smart Material :
Smart and Intelligent Materials-Piezoelectric Materials, Shape Memory Alloys & Polymers, Magnetostrictive Materials, Temperature Responsive Polymer, Halo chromic Materials, Smart Hydrogels, Chromomeric Systems, Photomechanical Materials, Self Healing Materials, Dielectric Elastomers. Bio cement, Phase change material.

Text Book: Building Materials, P.C. Varghese, Prentice-Hall India, 2555.

Reference Books:
1. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley, 1994.
2. Materials Science and Engineering, V. Raghavan, Prentice Hall, 1990.
3. Properties of Engineering Materials, R.A. Higgins, Industrial Press, 1994.
4. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press, 2551.
5. The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall, 1998.
6. Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann, 2553.
7. The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin, 1995.
8. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2556.
9. Properties of concrete, A.M. Neville, Pearson, 2554.
10. Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication

6CE04 :(II) GEOGRAPHIC INFORMATION SYSTEM & SCIENCE

Learning Objectives of Subject:

- To prepare the student to understand remote sensing, itꞌs techniques and interpretations.
- To introduce the concepts of image processing and basic analytical methods to be used in image processing
- To familiarize students with image enhancement, restoration techniques, and to understand different image compression techniques.
- To gain a basic, practical understanding of GIS concepts, techniques and real-world applications

Course Outcomes:
At the end of the course students will be able to

- Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis
- Perform image corrections, enhancements and generate high-level remote sensing products.
- Apply basic graphic and data visualization concepts such as colour theory, symbolization, and use of white space.
- Demonstrate proficiency in the use of GIS tools to create maps that are fit-for-purpose and effectively convey the information they are intended to.
- Apply mathematical concepts, including statistical methods, to data to be used in geospatial analysis.
- Review the fundamental concepts of a digital image processing system.

SECTION – A

Unit I: Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures.

Unit II: Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geo-stationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

Unit III: Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data.

SECTION - B

Unit IV: Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

Unit V: Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

Unit VI: Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

Books Recommended:

1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr. B C Punmia.

6CE04 PROFESSIONAL ELECTIVE – II (III) MASONRY STRUCTURES

Learning Objectives of Subject:

This course will enable students to

- Understand properties of masonry units, strength and factor affecting strength
- Understand design criteria of various types of walls subjected to different loads system
- Impart the culture of following the codes, for strength, serviceability and durability as an ethics.
- Provide knowledge in analysis and design of masonry elements for the success in competitive examination

Course Outcomes:

At the end of the subject the students will be able -

- Explain engineering properties and use of masonry units defect and cracks in masonry and its remedial measures
- Summaries various formulas for finding compressive strength of masonry units.
- Explain permissible stress and design criteria as per IS: 1905 and SP-20.
- Design different types of masonry walls for different load considerations.

SECTION A

Unit -I :- Masonry unit materials, types and masonry construction : brick, stone and block masonry unit- strain, modulus of elasticity and water absorption of masonry materials, classification and properties of Mortar. Defect and errors in masonry construction- cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and stability: strength and stability of axially loaded masonry walls, effects of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of aging, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Unit II:-Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and Lateral load, permissible tensile stress and shear stresses.

Design consideration: Effective height of wall and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. problems on design considerations for solid walls, cavity walls, walls with pillar.

Unit – III : Load consideration and design of Masonry walls subjected to axial loads: - Design criteria, Design of wall subjected to concentrated axial loads: - Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers,

SECTION B

Unit – IV: Design examples of walls under UDL, Solid walls ,cavity walls ,solid walls supported at the end by cross walls, walls with piers .

Unit – V : Design of wall subjected to eccentric loads: - Design criteria - stress distribution under eccentric loads -problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Design of laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of compound walls.

Unit –VI: Confined Masonry
Confined masonry construction, difference between confined masonry and RC frame construction. Earthquake resistance of confined masonry Structures. Earthquake-Resistant Confined Masonry Construction guidelines

TEXT BOOKS:
1. Dayaratnam P, Brick and Reinforced Brick Structures, Scientific International Pvt. Ltd.
2. M. L. Gambhir, Building and Construction Materials, McGraw Hill education Pvt. Ltd.
3. Anand S. Arya, Masonry and Timber Structures Including Earthquake Resistant Design Published by Nem Chand and Bros.
4. Svetlana Brzev , Earthquake-Resistant Confined Masonry construction , National Information center of earthquake engineering Indian Institute of technology Kanpur.

REFERENCE BOOKS:
1. Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication
2. Design of Masonry Structures By A.W. Hendry, B.P. Sinha, S.R. Davies
3. Design of Reinforced Masonry Structures, Second Edition, Narendra Taly, McGraw Hill education Pvt. Ltd

6CE04 :(IV) SOLID AND HAZARDOUS WASTE MANAGEMENT

Learning Objectives of Subject:
- To provide an overview of waste generation, waste characterization and waste management processes.
- To impart knowledge on solid waste management with particular emphasis on municipal solid waste management which includes different waste processing options such as pyrolysis, composting, and incineration; designing and operating sanitary landfill.
- To enrich knowledge about characteristics of hazardous wastes and their management.
- To impart knowledge on industry specific solid waste management practices.
- To provide an overview about the concept of land degradation and land reclamation

Course Outcomes:
At the end of the subject the students will be able -
- To identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- An ability to recognize waste minimization and source reduction, assess and describe the procedure for solid and hazardous waste identification and characterization and various waste processing options.
- Define and elucidate the management, treatment and disposal of hazardous wastes.
- Skill to assess and develop physical/chemical/biological treatment techniques for the control of hazardous wastes.
- Skill to address and describe solid waste management including landfill operation.
- Ability to design and execute land reclamation projects.

SECTION A

Unit I: Municipal solid waste: Definition, Sources and types of solid waste, composition and its determinants of Solid waste-factors influencing generation, quantity assessment of solid wastes, methods of sampling and characterization.

Unit II: Collection and Transfer Collection: Collection of Solid waste, collection services , collection system, equipments, time and frequency of collection. Transfer and Transport: Need for transfer operation, transport means and methods, Optimization of Transport Cost.

Unit III: Disposal of Solid Wastes Refuse disposal : various methods, incinerations, principle features of an incinerator, site selection and plant layout of an incinerator, sanitary landfill- methods of operation, advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control, equipments necessary, Energy Recovery.

SECTION B

Unit IV: Introduction: Definition, Need for hazardous waste management, Sources of hazardous wastes, Effects on community, terminology and classification. Storage and collection of hazardous wastes, Problems in developing countries, Protection of public health and the environment.

Unit V: Management of hazardous wastes: Identifying a hazardous waste, methods, Quantities of hazardous waste generated, Components of a hazardous waste management plan, Hazardous waste minimization, Disposal practices in Indian Industries, Future challenges.

Unit VI: Nuclear wastes and E-waste: Characteristics, Types, Health and environmental effects, Audit of E-Waste. Biomedical and chemical wastes: Biomedical wastes, Types, Management and handling, control of biomedical wastes & Chemical wastes.

Books Recommended:
1) George Techobanoglous et al, ñIntegrated Solid Waste Managementò McGraw - Hill, 1993.
2) Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.
3) R.E.Landreth and P.A.Rebers,ò Municipal Solid Wastes-Problems & Solutionsò. CRC press.
4) J. Glynn Henry and Gary. W. Heinke, ñEnvironmental Science and Engineeringò, Pearson publication.
5) A. D.Bhide and B.B.Sundaresan, ñSolid Waste Management ï Collection, Processing and disposalò Mudrashilpa Offset Printers, Nagpur, 2001.
6) Biomedical waste (Management and Handling) Rules, 1998.

6CE04 :(V) TRAFFIC ENGINEERING & MANAGEMENT

Learning Objectives of Subject:
1. To understand traffic planning & characteristics for urban roads.
2. To understand different surveys and methods of traffic volume study.
3. To understand the design of different intersections and use visual aids
4. To understand the Traffic safety & control devices to prevent road accidents.
5. To understand the traffic system management.
6. To know advanced technology used in traffic engineering.

Course outcomes:
At the end of the subject the students will be able ï
1. To explain the road characteristics & traffic planning.
2. To analyze traffic capacity of roads & intersection by different methods.
3. To design different types of road intersections & use of visual aids for roads.
4. To use knowledge of traffics safety & environmental hazards.
5. To recommend suitable traffic management system and traffic regularity measures.
6. To apply the knowledge of Intelligent Transportation System to traffic management system.

SECTION A

Unit I: Traffic Planning & Characteristics:
Road Characteristics ï Road User Characteristics ï PIEV theory ï vehicle ï Performance Characteristics ï Fundamental of traffic flow ï Urban Traffic problems in India ï Integrated planning of town, country, regional and all urban infrastructure ï towards sustainable approach ï Land use & transport and model integration.

Unit II : Traffic surveys:
Traffic surveys ï Speed, Journey time and delay surveys ï vehicles volume survey including non-motarized transport ï methods and interpretation ï origin destination survey ï accident analyses methods , interpretation and presentation ï statistical applications in traffic studies and traffic forecasting ï level of service ï concept, application and significance.

Unit III : Traffic design and visual aids:
Intersection Design ï channelization, Rotary intersection design ï signal design ï coordination of signals ï grade separation ï traffic signs including VMS and road markings ï significant roles of traffic control personnel ï networking pedestrian facilities & cycle tracks.

SECTION B

Unit IV: Traffic Safety and Environment :
Road Accident ï Causes, effects, prevention, and cost ï street lighting ï traffic and environment hazards ï air and noise pollution, causes, abatement measures ï promotion and integration of public transportation ï Promotion of non-motorized transport.

Unit V: Traffic Management:
Area Traffic management system ï traffic system management (TSM) with IRC standards _ Traffic Regulatory Measures ï Travel Demand Management (TDM) ï Direct and Indirect Methods - congestion and parking pricing ï all segregation methods ï coordination among different agencies

Unit VI : ITS : Intelligent transport system for traffic management, enforcement and education, Application of ITS to Traffic Management System- Public Transportation Management System.

(Open Elective II)
6CE05 : (i)Environmental Management

Learning Objectives of Subject:
The objective of the course is to provide skills and an improved understanding of how firms and organisations work with sustainability issues such as environmental and natural resource management in order to protect our eco system.

Course Outcomes:

At the end of the course the student will be
- Aware of different environmental problems, their causes and effects.
- Have knowledge regarding different environmental policies & management plans.
- Have thorough knowledge about Environmental Legislation and Acts.
- Acquire information about various agencies for Environmental Managements in India.
- Have knowledge regarding different systems working for Environmental Management.

SECTION – A

Unit I: Different environmental problems - Energy and the environment, Agriculture and the environment, the atmosphere and human activities, etc. Need for environmental management, the nature, scope and components of environmental management.

Unit II: Environmental policy analysis- micro level and macro level, methods of policy analysis, steps involved. : Operational methods, quantitative methods, statical analysis public policy analysis resource allocation, environmental economics etc.

Unit III: Environmental management plan (EMP): components of Environmental Management Plan, Preparation of Environmental Management Plan.

SECTION – B

Unit IV: Environmental Legislation and Acts: Water (prevention and control of pollution) Act1974,Air (prevention and control of pollution) Act 1981, environmental protection Act (EPA) 986, Hazardous waste rules1989, Factory Act 1984 amendments in 1987, Environmental Management System: ISO 14000(EMS) Environmental Audits: methods, components and preparation.

Unit V: Various agencies for Environmental Managements in India: Ministry of environment and forest, central pollution control boards, state pollution control boards, local bodies, - their scopes, organizational and functional issues, their working etc.

Unit VI: Basics of Data Base Management System (DBMS), Geographic Information System (GIS) and remote sensing in Environmental Management.

Books Recommended:

1. Environmental Impact Analysis- a decision Making Tool: By R KJain, McGraw ï Hill.
2. Theory and Practice of Environmental Impact Assessment: By Abbasi and Ramesh, Discovery publishing house pvt. ltd.

6CE05 :(II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATIONAL BEHAVIOR

Learning Objectives of Subject:

- Student should learn about concept of Management and its utility.
- Student should learn about various types of Organization and its structure.
- Learner should be able to understand the concept of Human Resource Management .
- Learner should understand self development process and its fixity for Organizational need .
- Student should be able to understand and develop skills of Leadership , Team Work , Professional behavior , Job analysis and ethics .
- Student should be able to analyze job , opportunities and growth criteriaôs.

Course outcomes:

At the end of the subject the students will be able -

- To understand the concept of Management and Organization.
- To understand types of Organization and Its structure.
- To develop himself/ herself as per the need and requirement of work and self updation.
- To develop better skills related to leadership, team behavior, ethics at working place .
- To analyze job opportunity and future in it .
- To understand expectations for job evaluation , assessment of work and growth in the field.

SECTION A

UNIT I:- Understanding the Term Management and Organization. Learning about various types of Organizations and Organizational chart. Concept and need for Human Resource Management (HRM) and Human Resource Development (HRD) . Concept, Origin and Need, for HRD as a Total System; Approaches to HRD; Human Development and HRD; Introduction to Organizational Behavior (OB) .

Unit II :- Knowing and Managing Yourself Individual Behaviour: MARS model of individual behaviour Values: Values across cultures (Hofstedeôs framework); Personality: Big five model; MBTI; Use of personality tests; Personality attributes influencing OB Emotions: Understanding emotions; Emotional labour; Emotional Intelligence Attitudes: Attitudes v/s values; Job Satisfaction; Organizational Commitment Perception: Factors influencing perception; Perceptual errors; Self-fulfilling prophecy; Know yourself: Johari window

Unit III :- Motivation in the workplace , What is motivation; Types of Motives; Theories of Maslow; Herzberg, McGregor, Alderfers, Porter and Lawlerôs Model; Job Enlargement, Job Enrichment, Behaviour Modification.

SECTION B

Unit IV :- Communication What is communication; Organizational communication: Formal networks and Grapevine; Electronic communications; Barriers to effective communication; non- verbal communication; Improving Interpersonal communication: Empathy and Active listening

Unit V :- Leadership Difference between managers and leaders; Perspectives of leadership: Trait, Behavioural, Contingency; Inspirational leadership: Transactional, Transformational, Charismatic; NGO leadership

Unit VI :- Job Analysis, Job description; Job Specification; Job Evaluation, Recruitment, Selection, Orientation Sources of recruitment: Internal and external; Steps in selection process; Performance Management , What is performance appraisal; Purposes, Process and Uses.
Compensation Management ï Need, Objectives and factors determining compensation; Developing pay structures, Executive remuneration; components of compensation; Incentives

Prescribed Books :

1. Nadler, Leonard : Corporat Human Resource Development, Van Nostrand Reinhold, ASTD, New York .
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi, 2004.
4. Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.

5. Rao, T.V.(et.al): HRD in the New Economic Environment, Tata McGraw-Hill Pub.Pvt, Ltd., New Delhi , 2003.
6. Management & Organisation , Dr A. R Gupta , Google book Publishers.
7. ILO, Teaching and Training Methods for Management Development Hand Book, McGraw-Hill, New York .
8. Rao, T.V: Human Resource Development, Sage Publications, New Delhi.
9. Kapur, Sashi: Human Resource Development and Training in Practice, Beacon Books, New Delhi.
10. Lynton, Rolf. P and Pareek, Udai: Training for Development, Vastaar Publishers, New Delhi
11. Viramani, B.R and Rao, Kala: Economic Restructuring, Technology Transfer and Human Resource Development, Response Books, New Delhi .
12. Jaya Gopakl, R: Human Resource Development : Conceptual analysis and Strategies, Sterling Publishing Pvt. Ltd., New Delhi .
13. Truelove, Steve. A: hand book of Training and Development, Beacon Books, New Delhi . 14. Goldstein, Irwin : Training in Organisations, Cole Publishing Co., California .

6CE05 : (III) INTRODUCTION TO EARTHQUAKE ENGINEERING

Learning Objectives of Subject:
This course will cover the basics of seismology and Earthquake engineering. Students will learn
1. Basic seismology, earthquake phenomenon and its characteristic.
2. Earthquake resistant concept.
3. Use of earthquake bands in masonry structure.
4. Behavior of buildings during earthquakes.

Course outcomes:
At the end of the subject the students will be able to -
1. Identify type of earthquake, its properties
2. Earthquake resistance planning
3. Apply knowledge of seismic bands in masonry structure construction
4. Solve engineering problems in the context of Earthquake Engineering.

SECTION A

Unit I: Interior of earth, engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, and Propagation of earthquake waves.

Unit II: Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicenter distance, Ground motion and their characteristics, Factors affecting ground motions.

Unit III: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings.

SECTION B

Unit IV: Projections & suspended parts, special construction features like separation of adjoining structure, crumble section, stair case etc., twisting of building, seismic effects on structures, inertia forces, horizontal & vertical shaking.

Unit V: Behavior of masonry structure during earthquake, bands & reinforcement in masonry building opening in walls, importance of flexible structures.

Unit VI: Behavior of R.C. building in past earthquakes. Concept of earthquake Resistant design, Introduction to IS: 1893.

Books Recommended:

1. Duggal S. K., Earthquake Resistant Design of Structures, Oxford University Press 2007
2. Amita Sinvhal; Understanding Earthquake Disasters, Tata McGraw Hill
3. P. N. Agraval; Engineering Seismology Oxford & IBH Publishing
4. C.V.R. Murty; Earthquake Tips National Information Centre of Earthquake Engineering IIT Kanpur
5. Pankaj Agrawal & Manish Shrikhande ; Earthquake Resistant Designof Structures Prentice- Hall of India

6CE06 : DESIGN OF STEEL STRUCTURE– LAB

List of Experiments:
1. Candidates are required to prepare at least **two** designs of steel structures based on theoretical course detailed working drawings are necessary.
2. A compulsory **site visit** for studying the various aspect and prepare a report. A Journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

6CE07: ENVIRONMENTAL ENGINEERING LAB – I

Minimum Eight (8) practicals out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

List of Experiments:
1. Determination of Turbidity of water sample
2. Determination of Electrical Conductivity water sample
3. Determination of pH of water sample
4. Analysis of Dissolved, Suspended and Total solids

5. Analysis of Volatile and Fixed solids
7. Optimum coagulant dose
8. Determination of Temporary and Permanent Hardness of water sample
9. Determination of Acidity & Alkalinity of water sample
10. Determination of Iron and Manganese
11. Determination of residual chlorine in the given water sample
12. Total Count of Bacteria Test.

6CE08 : FLUID MECHANICS – LAB

Suggested Fluid Practicals :
Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

1. Verification of Bernoulliĝs theorem.
2. Determination of coefficient of discharge for Venturimeter.
3. Verification of Reynoldĝs Number with respect to type of flow.
4. Determination of metacentric height.
5. Determination of friction factor for GI pipe.
6. Determination of coefficient of discharge for rectangular notch.
7. Determination of coefficient of discharge for triangular notch.
8. Determination of Chezyĝs coefficient.
9. Determination of coefficient of discharge of Venturiflume.
10. Verification of momentum equation.
11. Study of hydraulic jump, calculations of height of jump, length & energy loss.

6CE09: MINI PROJECT

Any one Group Project in details:
1) Irrigation Project
2) Rehabilitation of Village / Town
3) Water Supply Project
4) Sewerage System
5) Bridge on River
6) Flood Relief Structures
Students should conduct a detailed survey in a seven day camp.
Data Analysis, Design & Submit Report & Drawing sheets.

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SYLLABUS PRESCRIBED FOR SEMESTER V & VI OF B.E. (MECHANICAL ENGG.)

SEMESTER – V

5ME01 HEAT TRANSFER

Course Learning Objectives (CLOs):
1. To provide details of heat transfer involving conduction, convention and radiation mechanisms.
2. To carry out heat transfer analysis and to demonstrate different techniques used in solving a heat transfer problem.
3. To impart basics of designing heat transfer equipment.

Course Outcome (COs) :
At the end of Heat Transfer course the student will be able to:

1. Solve steady state heat transfer problems of 1-D heat conduction with and without internal heat generation.
2. Design and to analyze the performance of extended surfaces.
3. Apply Lumped heat capacity method for analysis of unsteady state heat transfer.
4. Explain the laws of radiation and its applications.
5. Predict heat transfer coefficients for forced and free convection heat transfer applied to internal and external flow conditions.
6. Design and analyze the performance of heat exchangers using NTU and LMTD methods.

UNIT - I : Introduction, heat transfer in engineering, modes of heat transfer, basic laws of heat transfer and their basic equations. Conduction-thermal conductivity and thermal diffusivity effect of phase &temperature on thermal conductivity, one dimensional steady state heat conduction through slab, cylinder & sphere-simple and composite. Combined conduction- convection, overall heattransfer coefficient. General heat conduction differential equation. One dimensional steady state conduction with internal heat generation for infinite slab, wire & cylinder. (8 Hrs)

UNIT II : Insulations, critical radius of insulation, Conduction through extended surfaces, analysis of a uniform C.S. fin, fin efficiency, fin effectiveness, Biot number. Introduction to unsteady state heat conduction, Newtonĝs law of cooling, lumped heat capacityanalysis. **(8 Hrs)**

UNIT III : Radiation-general concepts and definitions, black body & greybody concept. Laws of radiation - Kirchoffĝs Plankĝs, Stefan- Boltzmanĝs, Wienĝs law. Concept of shape factor, emissivity factor and radiation heat transfer equation. (No numericals).Radiation errors in temperature, measurement, radiation shield. (7 Hrs)

UNIT IV: Forced convection- heat convection, forced and natural convection, boundary layer theory, hydrodynamic & thermal boundary layers, boundary layer thickness. Laminar & turbulent flow over flat plate and through pipes & tubes (only concept, no derivation & analytical treatment). Dimensionless number and their physical significance Reynold, Prandtl, Nusselt, Grashoff number, empirical correlations for forced convection for flow over flat plate, through pipes & tubes & their applications in problem solving. **(8 Hrs)**

UNIT V: Free convection- velocity and thermal boundary layers for vertical plate, free convection over vertical cylinder and horizontal plate/cylinder (only concept, no derivation & analytical treatment). Use of empirical correlations in problem solving. Condensation & Boiling - introduction to condensation heat transfer, film & drop condensation. Boiling heat transfer, pool boiling curves. **(7 Hrs)**

UNIT VI : Heat exchanger - applications, classification, overall heat transfer coefficient, fouling. L.M.T.D. & E.N.T.U. methods, temperature profiles, selection of heat exchangers. Introduction to working of heat pipe with and without wick. **(7 Hrs)**

Books Recommended:

Text Books:-
1. Heat and Mass Transfer; R.K Rajput; S. Chand, New Delhi.
2. Heat and Mass Transfer; V.M. Domkundwar; Dhanpat Rai & Co. Delhi.
3. Heat Transfer; A. F.Mills, V. Ganesan, Pearson Publication.

Reference Books:-
1. Heat Transfer; J.P. Holman; McGraw Hill
2. Heat Transfer; P.K. Nag; TMH.
3. Heat and Mass Transfer Data book, V.M. Domkundwar, Dhanpat Rai & Co.
4. Heat and Mass Transfer Data book; C.P. Kothandaraman; New age International.

5ME02 METROLOGY & QUALITY CONTROL

Course Learning Objectives:
1. To study generalized production technology, applications, general configuration and functional elements of inspection instruments.
2. To study about quality in production and services and quality management.
3. To study application of non destructive test for increasing productivity and efficiency of the work.
4. To study design and applications of various gauges and comparators used in inspection.
5. To study various techniques for the inspection of gears and threads.
6. To study various techniques for angular measurement, surface texture measurement, and geometric features measurement.
7. To study advance inspection techniques CMM, profile projector etc.

Course Outcomes:
1. Create & apply the concept of inspection, quality control and its importance to industry.
2. Demonstrate the skills of controlling various out of control processes using statistical quality control tools.
3. Understand the importance of improving production and productivity using work study approach.
4. Apply the knowledge of various measurement standards and techniques in the industry to measure various parameters related to metrology.

UNIT I : Concept of quality and quality control, quality of design and quality of conformance, Quality characteristics, Cost of quality & Value of quality, Specification of quality, quality control & inspection.
Concept of TQM & Quality assurance, Concept of variation, variable and attribute data, Frequency distribution, Measures of Central tendency - Mean, mode & median, Measures of dispersion. -Range, std.deviation & variance. (8 **Hrs**)

UNIT II : Concept of universe and population, Normal distribution curve; Control charts for variables, process capability, Control charts for attributes; comparison between variable charts and attribute charts; precision & accuracy, Sampling plans,Operating Characteristic curve, Quality circle (7 **Hrs**)

UNIT III : Introduction to Non-Destructive testing, Ultrasonic testing, X-ray or Radiography Testing, Liquid Penetrant testing, Magnetic Particle Testing, Eddy current testing, itȏs applications, Advantages & Disadvantages. (7 **Hrs**)

UNIT IV : Standards of measurements: line standards, end standard, wave length standard. Limits, fits and gauges: terminology of limits, Fits and gauges, concept of interchangeability, allowance tolerance, Indian Standard Specification for limits, fits and gauges, B.S. System. Limit gauging - design of Go, No Go gauges. (8 **Hrs**)

UNIT V : Linear measurement: various comparators such as mechanical, electrical, optical, pneumatic comparators, their principle, operations and applications.
Angular measurements: vernier, optical, bevel protractor universal bevel protector, Sine bar level clinometers, taper gauges. Thread measurement: screw thread limit and fit limits gauging of screw threads (8 **Hrs**)

UNIT VI : Gear measurement : alignment error, master gear, Parkinson tester. Study and use of optical dividing head, auto collimator, tool makers microscope. Interferometry, flatness testing, squareness testing. Surface texture testing. Coordinate measuring machine- types, role and application. **(7 Hrs)**

Books Recommended:

Text Books:

1. Engineering Metrology ï R.K.Jain - Khanna Publishers.
2. Statistical Quality Control- M. Mahajan ï Dhanpatrai & Co. Pvt.Ltd.
3. Non Destructive Testing techniques by Ravi Prakash, New Age Publications.

Reference Books:

1. Quality Control - By Juran - Mc. Graw Hill Pub. Company.
2. Statistical Quality Control- By Grant E.L. ï R.S.L.Leavgen Worth-.Mc. Graw Hill Pub. Company
3. Statistical Quality Control- By Gupta - Dhanpatrai & Com. Pvt. Ltd

5ME03 KINEMATICS OF MACHINES

Course Learning Objectives:

1. To get the basic Knowledge about the mechanism used in automobiles, industrial machines etc.
2. To study about the synthesis and analysis of the mechanism used in machines.
3. To get the operational knowledge about the power transmitting devices used in automobiles.
4. To study the designing and importance of cams in machines.
5. To study the most effective power transmission device used in automobiles, industrial equipment, toys, etc**.**

Course Outcomes:

Students will be able to-

1. Understand & apply the concept and its applications of link, mechanisms and machines.
2. Demonstrate the ability to analyze the mechanisms and machines on the basis of velocity and acceleration and they will show the ability to solve analytical methods.
3. Show the ability to use graphical and analytical methods for synthesis of mechanisms to develop mini projects in the course duration.
4. Understand the practical for study of brake, clutch, dynamometer, gear train etc.

Unit I: 1. Introduction to study of mechanisms, machines, different types of links, kinematic pairs. Grashofôs law-class-I and class ï II mechanisms. Grublerôs criterion, Kutzbachôs criterion for planer mechanism. Inversions of four bar, single slider, double slider mechanisms.

2. Transmission angle, Mechanical Advantage, Transmission angle and Mechanical Advantage of 4-bar mechanism. **(7 Hrs)**

Unit II: 1**. Velocity analysis**: - Relative velocity method, method of equivalent mechanisms, Instantaneous centre of rotation method for 4-bar mechanism, body and space centroids.

2**. Acceleration analysis**:- Relative acceleration method and analytical method. **(8 Hrs)**

Unit III: Synthesis of Mechanisms:- Introduction to type, number and dimensional synthesis, graphical method of two position, three position and four position synthesis for input output coordination, Freudenstienôs equation, Blochôs method. **(7 Hrs)**

Unit IV: Frictional torque in pivot and collar bearing. Clutches and Dynamometers: types, constructional details, operation. **(7 Hrs)**

Unit V: Special purpose mechanisms:- Steering mechanisms, Geneva wheel mechanism. **Cams**:- Introduction, types of cam & follower, different motions of followers, graphical layout of cam profiles, cam with specified contours. (8 Hrs)

Unit VI: 1. **Gear**: Introduction, terminology, gear tooth profiles, law of gearing, involumetry, interference of spur gears, minimum number of teeth to avoid interference.

2. **Gear Trains**:- Types of gear trains and its speed ratio applications. **(7 Hrs)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai and sons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by EurasiaPublishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker andGordon, Published by Oxford University press-New York.
2) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
3) Theory of Machines and Mechanisms, Ghosh and Amitabh, PublishedAffiliated East West Press, N-Delhi.

5ME04 MEASUREMENT SYSTEMS

Course Learning Objectives:

1. To study the generalized measurement system and the general performance characteristics of measuring instruments, applications, general configuration and functional elements of measuring instruments.
2. To study the strain gauges, their types, strain gauge circuits for strain measurement and to study the pressure measurement methods and devices
3. To study the types, constructional details and working of force, torque and flow measuring devices.
4. To study the different types of temperature measuring devices, standards, construction details and their working and to study the different types of liquid level measuring devices.
5. To study the mechanical and electrical types of speed measuring devices, contact and contactless speed measuring devices and their applications.
6. To study the methods of vibrations measurement and methods of linear and angular displacements.

Course Outcomes:

At the end of Measurement System course, the student will be able to:

1. Analyze different measurement systems.
2. Calculate different types of errors in the measurement system.
3. Use strain gauges and pressure measurement devices for several applications.
4. Compare different methods of force, Power and flow measurement using different methods.
5. Select appropriate liquid level and temperature measurement devices for given applications.
6. Measure speed of motors and rotating shafts by using tachometers, stroboscope.

UNIT I : 1. Generalized Measurement system: Significance of measurement, generalized systems. application of measuring instruments. Types of measuring instruments.

2. General configuration and functional elements of measuring instruments, types of inputs, various methods of correctionfor interfering and modifying inputs. (6 Hrs)

UNIT II : General performance Characteristics:-

1. Static characteristics, different types of errors, combination of component errors in overall systems.
2. Dynamic characteristics: General mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency. (8 Hrs)

UNIT III : Strain Measurement :

1. Types of strain gauges, strain gauge circuits, calibration, Temperature compensation, use of strain gauges on rotating shafts, selection and installation of strain gauges.
2. Pressure Measurements:- Basic methods of pressure measurement: strain gauge pressure cell, High pressure measurement Bridgeman type, low pressure Measurement - Mcleod, Knudsen, ionisation, Thermal conductivity gauges. **(8 Hrs)**

UNIT IV : 1. Force Measurement: Various mechanical. Hydraulic, pneumatic and electrical methods.

2. Torque and Power Measurements: Various mechanical, hydraulic & electric methods.
3. Flow Measurements: Construction- orifice, Rota meter. Pressure probes- Pitot static tube, turbine meter, electro-magnetic flow meter. **(6 Hrs)**

UNIT V : 1. Temperature Measurements : Standards, Various temperature measuring devices, Bimetallic strip, pressure thermometers, thermo couples, electrical resistance thermometers, Thermistors, radiation Thermometers.

2. Liquid Level Measurements : Various methods such as- single float, displacement or force transducers. Pressure sensitivity, bubbler or Page system, capacitance variation type (for both conducting and non conducting type liquids) Resistance variation type. **(8 Hrs)**

UNIT VI: 1. Speed Measurements: Various mechanical type tachometers, electrical types tachometers, stroboscope etc.

2. Vibration Measurements : Seismic, Strain gauge and piezoelectric accelerometers.
3. Displacement measurements : Linear and angular displacement measurements, LVDT, LDR, Capacitive & inductive pick ups. (**8** Hrs)

BOOKS RECOMMENDED:

Text Books:-

1. Measurement Systems : - By Erenest O. Doebelins - MC Graw Hill.
2. Mechanical Measurement & Control: By D.S.Kumar.

References Books:-

1. Mechanical Measurements :- By T.G.Beckwith & N.L.Bulk - AddisonWerllv.
2. Instrumental Measurement & Analysis : By Nakra Choudhari TataMc Graw Hill.
3. Mechanical Measurement & Instrumentation : By R.K.Rajput,KatsonsBooks Publications.

5ME05 OPEN ELECTIVE - I (1) PRODUCTION MANAGEMENT

Course Learning Objectives:

1. To study the new product design & manufacturing process technology.
2. To study the objectives of forecasting, factors affecting forecasting.
3. To study method study, work measurement.
4. To study objectives and functions of Production Planning and Control.
5. To study inventory control & inventory control application
6. To study quality management, quality related costs, quality function deployment & total quality management.

Course Outcomes:

1. Apply the knowledge of operations management and its applications in industrial environment.
2. Demonstrate the knowledge of advanced manufacturing technologies and philosophies.
3. Students will demonstrate the importance of inventory control, JIT in manufacturing.
4. Apply the basic concept of quality management, TQM etc.

UNIT I: Designing products, services and processes; Historical evolution of productions and operations management, newproduct designs, manufacturing process technology.
Flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM). **(9 Hrs.)**

UNIT II: Sales Forecasting: Objectives, types of forecasting, factors affecting forecasting, process of sales forecasting, methods of sales forecasting. **(7 Hrs.)**

UNIT III : Work study: method study, recording techniques of method study, principles of motion economy. Work measurement techniques. **(7 Hrs.)**

UNIT IV: Production planning and control: Objectives and functions of PPC, types of production systems, principles of sound production control system. **(7 Hrs.)**

UNIT V: Inventory Control: Demand and control system characteristics, inventory concepts, costs Modeling, Deterministic inventory models, stochastic inventory models, inventory control application, just-in-time manufacturing. **(7 Hrs.)**

UNIT VI: Quality Management: Quality and quality related costs, quality function deployment(QFD), Taguchiọs off-line quality control methods, managerial responsibility in managing for quality products & services. TQM. Failure analysis, bath tub curve, Reliability of system. **(8 Hrs.)**

Books Recommended:

Text Books:

1. Production and operations management- concepts models and Behaviour by Everett E. Adam,Jr., & Ronald J. Ebert (Prentice- Hallof India)
2. Industrial engineering & production Management by M. Mahajan(Dhanpat Rai & Co.)

References Books:

1. Production and operations management ï Total Quality and responsiveness by Hamid Noori & Russell Radfort (Mc Graw Hill, Inc.)
2. Industrial engineering & management by O. P. Khanna (Dhanpat Rai& Co.)
3. Production and Operations Management; J.P. Saxena; McGraw Hill.

5ME05 OPEN ELECTIVE-I
(2) MANUFACTURING TECHNIQUES

Course Learning Objectives:

1. To study the fundamentals of different manufacturing processes and various activities in manufacturing.
2. To study the fundamentals of metals & alloys, properties of engineering materials like ferrous, non- ferrous metals and their alloys
3. To study different machine tools. cutting tools used in machine shop , various operations performed with working principles of these machine tools
4. To study the activities related to mechanical working of metals, various hot working & cold working operations fundamentals of metal forming ; sheet metal working processes with different tools and equipment
5. To study the necessary details regarding pattern making, moulding, core making and casting with foundry tools & equipment, also melting practice by cupola furnace.
6. To study different Joining processes, basic terms of welding processes tike arc welding, gas welding, resistance welding. friction welding , soldering ; brazing processes with tools & processes.
7. To study the methods of producing metal powders
8. To study plastic part manufacturing by different processes like extrusion. Injection, blow, compression, and transfer moulding processes.

Course Outcomes:

1. Apply the knowledge of various manufacturing techniques and its applications in engineering.
2. Understand the knowledge of machining operations, sheet metal working and processes.
3. Students will show the ability to apply various joining methods in practice.
4. Students will exhibit the knowledge of powder metallurgy.

Unit I : Overview of manufacturing: Classification of manufacturing processes, selection of manufacturing processes, types & properties of materials, selection of materials, Introduction to conventional and non-conventional machining processes. (6Hrs)

Unit II : Introduction to cutting type shaping processes, Basic concept of metal cutting, Types of cutting tools, Orthogonal & oblique cutting, General purpose machines Vs Special purpose machines. (8Hrs)

Unit III: Introduction & application of various metal cutting operations ï Turning, drilling, boring, milling, shaping, planning and grinding process. (8Hrs)

Unit IV: Introduction to metal forming and sheet metal process: Forming process- Forging, rolling, extrusion, wire drawing. Sheet metal processes- Forming, bending, drawing, coining, embossing. Cutting process: Punching, blanking, shearing, lancing. (7Hrs)

Unit V : Metal casting: Steps involved in casting, advantages of casting, pattern, difference between pattern and casting, pattern allowances, material used for patterns, molding sand, sand mould making core, types of cores, defects of castings, melting furnace(Cupola), casting process and its applications. (6Hrs)

Unit VI: Joining process with its types, advantages and disadvantages of riveting, soldering, brazing. Arc welding, gas welding, resistance welding, friction welding. (6Hrs)

Books Recommended:

Text Books:

1. Manufacturing processes ï Workshop practice, R.A. Khan, Ali Hassan, Scitech Pub.
2. Workshop Technology - Hajra Chaudhary, Dhanpat Rai and Sons.

Reference Books :

1. Processes and materials of manufacture E.P. Degarmo, Prentice Hall of India (PHI)
2. Material and processes in manufacturing Lindberg, Tata McGraw Hill Pub.

5ME06 HEATTRANSFER - LAB.

Course learning objective: The lab work should clear the vision about all the modes of heat transfer. The practical knowledge should enhance the approach of student towards real life applications of the subject.

Course Outcomes:

Upon successful completion of lab Course, student will be able to:

i) Understand various modes of heat transfer

ii) evaluate various parameters of the heat transfer process

List of Practicals (Any six of the following):-

1. Determination of thermal conductivity of a metal bar.
2. Determination of thermal conductivity of insulating powder.
3. Study of heat transfer through composite wall.
4. Study of heat transfer through composite cylinders.
5. Determination of fin efficiency.
6. Verification of Stefan-Boltzmanôs law.
7. Determination of emissivity of grey body.
8. Determination of heat transfer coefficient for forced convection.
9. Determination of heat transfer coefficient for natural convection.
10. Study of pool & nucleate boiling.
11. Trial on double pipe heat exchanger.
12. Determination of efficiency of cross flow heat exchanger.
13. To write a computer program for conduction heat transfer problem.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

5ME07 METROLOGY & QUALITY CONTROL - LAB.

Course learning objective:

The course aims at understanding the principles of metrology for precision measurement of various mechanical components using various measuring tools. Students shall also learn to use standard practices and standard data, learn to use statistical concept, control chart for variables, control chart for attributes.

Course Outcomes:

Upon successful completion of lab Course, students will be able to:

i) Explain the principles involved in measurement and inspection.

ii) Select and use appropriate measurement instrument for a given application

iii) Apply the basics of sampling in the context of manufacturing

Practicals : At least six from the below list.

1. Determination of Linear dimensions of a given specimen/part using Precision/Non-Precision Measuring instruments.
2. Determination of Angular Measurement using Precision/Non-Precision Measuring instruments.
3. Measurement of Gear Tooth Thickness by Gear Tooth VernierCaliper/Constant Chord/Span Micrometer.
4. Measurement of Circularity/Roundness of a given specimen.
5. Measurement of Screw Thread Element by Floating Carriage Micrometer.
6. Testing of Surfaces by using Optical Flat.
7. Measurements of various angles of single point cutting tool by usingProfile Projector and Tool Makerôs Microscope.
8. Preparation of Variable Control Charts for the given lot of sample.
9. Preparation of Attribute Control Charts for the given lot of sample.

Practical Examination:- The practical examination shall consist of oral on term work.

5ME08 KINEMNATICS OF MACHINES - LAB.

Course Learning Objectives: Objectives of this lab are to impart practical knowledge on design and analysis of mechanisms for the specified type of motion in a machine. With the study of rigid bodies motions and forces for the transmission systems, machine kinematics can be well understood.

Course Outcome: On successful completion of the course students will be able to:

Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship, identify the basic relations between velocity & acceleration and use graphical and analytic methods to study the motions of various mechanisms

Practicals: - *At least eight practicals from the below list shall beperformed.*

1. To Study, Analyse and drawing of inversions of four bar mechanism to identify the types and number of links, types of motion and its mode of fixing arrangement for the required application.
2. To Study and analyse of inversions of slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
3. To Study and analyse of inversions of double slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
4. To determine Velocity and acceleration of links in mechanism by relative velocity method. (2 Problem)
5. To determine Velocity and acceleration of Piston of a reciprocating engine by cleinôs construction method. (2 Problem)
6. To find braking force, braking toque of internal expanding and external expanding brake .

7. To study, understand and observe the actual working and function of each part of single plate clutch by dismantling and assembling.
8. To study, understand and observe the actual working and function of each part of centrifugal clutch by dismantling and assembling.
9. Study of dynamometers.
10. To draw Cam profile for a given follower type and follower motion. (2 Problem.)
11. To Study and find train value and speed ratio of various types of gear trains
12. To study and drawing of Simple four bar Mechanism using position synthesis.
13. To Study and drawing of four bar mechanism by input-output coordination methods using Blochôs Synthesis and Freudensteinôs equation.
14. To study interference and undercutting of spur gear pair using graphical layout.
15. To study and drawing of Generation of Involute and Cycloidal Spur Gear Tooth Profile.

The practical examination shall consist of viva-voce on the above syllabus & practical work.

5ME09 MEASUREMENT SYSTEMS -LAB.

Course Learning Objectives :

i)To study various sensers and measuring instruments required to measure various properties and quantities occurring in a typical engineering system.

ii)To understand general performance characteristics of measuring instruments, applications and general configuration of the measuring instruments.

Course Outcomes: Upon completion of this course students will be able to:

i) Choose appropriate measuring device for measurement of various quantities
ii) Analyse the performance of various
iii) Analyse and execute the calibration process for measuring instruments

List of Practicals :

At least eight practicals from the following list:

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-uptransducers.
4. Performance of capacitance transducer as an angular displacementmeasuring device.
5. Performance of inductive Transducers.
6. Measurement of flow using optical flow meter and Rotameter.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or photo electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement by using Seismic Transducer.
11. Measurement of Liquid level by using capacitive pickup transducer.
12. Temperature measurement using contact and non contact type instruments or various types of sensors.

*The practical examination shall consist of viva-voce on the above syllabus & practical work.

SEMESTER: SIXTH

6ME01 DESIGN OF MACHINE ELEMENTS

Course Learning Objectives (CLOs):

1. To study the concept of stresses and understand the design procedure of riveted and welded joints.
2. To study design procedure of knuckle joint, springs and power screw.
3. To analyze & select types of shafts, keys, couplings for various machines and industrial applications.

COURSE OUTCOMES (COs):

1. Understand the concept of various stresses and apply the design procedure to riveted joints and welded joints.
2. Understand design procedure of knuckle joint, springs and power screw.
3. Analyze & select types of shafts, keys, couplings for various machines and industrial applications.
4. Analyze the various types of bearings and understand the design procedure of IC Engine parts.

Unit I : (A) Meaning of design, Phases of design, Simple stresses, Thermal stresses, Impact Stress, Torsional stress, bending stresses in straight & curved beams, itôs applications, Hooks, C-clamps.
(B) Rivetted Joints- Design, failures, strength & efficiency of riveted joint.
(C) Welded Joint- Strength, of transverse & parallel fillet welded section. **(11 hrs)**

Unit II : (A) Design of knuckle joint.
(B) Design of spiral & leaf spring.
(C) Design of power screw- Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, ACME threads, stresses in power screws. **(11 hrs)**

Unit III : (A) Design of Shaft ï Subjected to twisting, bending & combined twisting & bending loads, based on rigidity.
(B) Design of coupling, rigid coupling, sleeve, muff coupling, flange coupling & flexible coupling. **(**11 hrs**)**

Unit IV : (A) Antifriction bearing: Types of bearing, construction, life of bearings, selection of bearings.
(B) Journal bearing: Lubrication, selection of lubrication, design procedure & numerical.
(C) Design of IC Engine parts: Connecting rod, design of flywheel based on TM diagram. **(11 hrs)**

Books Recommended :-

Text Books:

1. Machine Design by Dr. P.C. Sharma & dr. D. K. Agrawal, Katsons Publications Ltd.
2. Machine Design by R.K.Jain ,Khanna Publisherõs
3. Machine Design, R.S. Khurmi, J.K. gupta, Eurasia Publications, New Delhi.
4. Machine Design Data book by PSG, Coimbtore
5. Machine Design data book by Mahadevan.

Reference Books:-

1. Design of Machine Element by V.B. Bhandari, Tata McGraw Hill Publuication.
2. Machine Design ï Jindal, Pearson Publication.
3. Design of Machine Element ï C. S. Sharma & Kamlesh Purohit, PHI Publication.

6ME02 DYNAMICS OF MACHINES

Course Learning Objectives:

1. To study Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic effect on ship, aeroplane, four wheeler and two wheeler
3. To determine natural frequency vibrations.
4. To seek the knowledge of static and dynamic balancing.

Course Outcomes:

Students will be able to:

1. Apply basic concept of static force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of free vibration and force vibration, concept of Torsional vibration.
5. Analyze the concept of balancing of machinery.

Unit I: 1. Static equilibrium, superstition principle, Static force analysis applied to plane motion mechanisms, virtual work method, static force analysis without and with friction.

2. Theory of hydrodynamic lubrication, boundary lubrication, film lubrication, rolling friction, performance of bearing. (8 Hrs)

Unit II: 1. DõAlemberts Principle. Engine force analysis-piston effort, thrust along connecting rod, side of cylinder, on the bearings, crank effort and turning moment on the crank shaft.

2. Dynamic equivalent system of connecting rod.

3.Turning moment diagrams for two stroke, four stroke and multi cylinder engines, fluctuations of speed & energy, Flywheel requirements. **(7 Hrs)**

Unit III: 1**. Space mechanism**:**-** Gyroscope, gyroscopic effect as applied to ship, aeroplane, four wheeler, two wheeler, universal joint.

2**. Vehicle dynamics**: **-** Coefficient of adhesion, resistance to vehicle motion, relative drive effectiveness, braking of vehicles. **(7 Hrs)**

Unit IV: Types of vibrations, elements of mechanical vibrating systems, degree of freedom in mechanical vibratory system.

1. **Longitudinal vibrations-** Natural frequency of free longitudinal vibrations by equilibrium, energy and Rayleigh method. Effect of inertia constraint in longitudinal vibrations. Damped vibrations with mass, spring and dash pot. Definitions of logarithmic decrement, magnification factor, transmissibility, vibration isolation.

2. **Torsional vibration-**single rotor systems, Two Rotor system, three rotor system, geared systems. **(**8 Hrs**)**

Unit V: 1.**Transverse vibrations-** Natural frequency of free transverse vibrations. Effect of inertia constraints in transverse vibrations. Natural frequency of free transverse vibrations due to point load and uniform distributed load acting over a simply supported shaft. Frequency of free transverse vibrations of a shaft subject to a number of point loads by energy and Dunkerleyõs method.

2.**Whirling or critical speed shaft**. (6 Hrs)

Unit VI: Balancing :- Balancing of rotating masses in same and different transverse planes, Partial balancing of reciprocating masses & Study of its effect. **(**8 Hrs**)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai andsons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
4) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by EurasiaPublishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker andGordon, Published by Oxford University press-New York.
2) Theory of Machines and Mechanisms, Ghosh and Amitabh, published affiliated East West Press N-Delhi.

6ME03 CONTROL SYSTEM ENGINEERING

Course Learning Objectives:

1. To study the basics of control systems and their mathematical modeling along with reduction methods.
2. Study the basic control actions and Industrial controllers.
3. To study the analysis of control systems with respect to transient time response and their errors.
4. To study the different pneumatic controllers and prime movers and their actions.
5. To understand stability analysis, frequency analysis by using bode plot for analytical problems.
6. Study of important automatic speed control systems.

Course Outcomes:

1. Understand the basic system concept and study different types of systems.
2. Understand the concept Transient- Response analysis and will apply in numerical methods, the knowledge of basic control action and industrial controllers.
3. Understand the concept of Stability and exhibit the knowledge of root locus concept.
4. Understand the concept of Frequency Response method and use bode diagram in solving analytical problems.

Unit I: Introduction system concept, open & closed loop systems, Mathematical models of physical systems, transfer functions. Block diagrams reduction and signal flow graphs. (8 Hrs)

Unit II : Basic control actions and Industrial controllers :-Classification of industrial automatic controllers, control actions, proportional controllers, obtaining derivative and integral control action, effects of integral and derivative control action on systems performance. (7 Hrs)

Unit III : Transient Response Analysis :- Introduction Std. Test signals, steady state response of first and second order systems for stop, ramp and impulse input, transient response specifications, steady state error & error constants. (7 Hrs)

Unit IV: Concept stability, necessary condition for stability, Rauths stability criterion, Root locus concept, construction of Root loci, systems with transporation lag. (8 Hrs)

Unit V : Frequency Response methods :-Introduction, concept of Bode diagrams. (7 Hrs)

Unit VI : Study of important automatic speed control systems in machine tools, Prime movers, system generators, etc. Analysis of performance characteristics. (7 Hrs)

BOOKS RECOMMENDED:-

TEXT BOOKS :

1. Automatic Control Engineering by F. H. Ravan Mc-Graw-Hill.
2. Modern Control Engg. - by Katsuhiko Ogata, PHI, .
3. Control System Engg. - by Nagrath & Gopal.

REFERENCE BOOKS:

1) Automatic Control Engg. - by Kuo B.C. & F. Golnaraghi,
2) Modern Control System by Richard C. Dorf, Robert H. Bishop,

6ME04 PROFESSIONAL ELECTIVE-I (1) TOOL ENGINEERING

Course Learning Objectives (CLOs):

1) To study the basic geometries of different cutting tools, chip formation mechanism, tool force analysis etc. in metal cutting.
2) To understand the steps in designing and drawing of single and multipoint cutting tools and form tools.
3) To study the basic principles of workpiece positioning and clamping. To get acquainted with designs of locators, clamps, drill bushes and methods of location.
4) To understand the design and operation of various types of Jigs and Fixtures.
5) To develop a graphical design of a jig or fixture suitable to the requirements of a workpiece.
6)To understand the theory of metal cutting and how to estimate the required force and clearance amount in sheet metal cutting and forming operations.
7)To study construction and working of various types of dies used for different press working operations.
8) To study the steps in designing and drawing of different cutting, drawing and forming dies in press working.

Course Outcomes:

1. Create the design of single and multi-point cutting tools.
2. Apply the knowledge related to machining in order to estimate tool life and selection of cutting fluids.
3. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
4. Analyze the real time problems of work holding by designing jigs and fixtures.

Unit I: Single Point cutting Tool: Shear angle, shear strain, velocity relations, un-deformed chip thickness, Merchant's circle, energy relations, nomenclature, single point cutting tool design, recommended speed, feed and depth of cut Form tools. Graphical approach of circular form tool design. (08 Hours)

Unit II: Jig & Fixture Design: Economics, principles of locations, types of locations, prevention of jamming, problems of chip & dust in location, use of dowels. Redundant location, Principles of clamping, types of clamps, power clamping, Tool guiding & tool setting, types of drill Jigs & fixtures, (07 Hours)

Unit III: Jig & Fixture Design: Design of Plate, Channel, Box, Turnover and Post type Drill Jigs. Design of Turning, Milling, Fixture, Broaching, Assembly & Welding Fixtures. (07 Hours)

Unit IV: Multi-point Cutting Tools: Types, Geometric elements and forces in various tools like Twist drills & Reamers, Circular Broaches, Milling Cutters, Taps and Dies, Gear shaper cutter & Gear Hobs. (07 Hours)

Unit V: Press tools: Classification of presses, Theory of sheet metal cutting, clearance, cutting force calculations, Methods of reducing cutting forces, Centre of pressure & its significance, Classification of press working operations, Theory of bending, spring back action in metals, drawing fundamentals, calculation of drawing & bending forces, planning for cupping operation, Stock layout. (07 Hours)

Unit VI : Design of Press working Tools: Types of die construction, function & nomenclature of die components, Cutting Dies- Blanking & Punching, Forming Dies-Forming, Drawing and Bending etc. Design of Compound, Combination and progressive dies miscellaneous dies- Horn die, Cam-action die, Rubber & Building die, Suppress die. (08 Hours)

Text Books:
1. Tool Design - Cyril Donaldson (Tata Mc-graw Hill)
2. Jigs & Fixtures - P.H.Joshi (Tata Mc-graw Hill)
3. Fundamentals of Metal Cutting & M/c Tools - Juneja (New Age International).
4. Fundamentals of Tool Design - A.Kumar (Dhanpatrai & Sons).
5. A Text book of Production Engineering- P.C.sharma (S.Chand Publication).

Reference Books :
1. Metal Cutting Theory & Cutting Tool Design- Arshinov (Mir Publications)
2. Tool Design - ASTME (ASTME)
3. Jigs and Fixture- Grantt.

6ME04 Professional Elective – I (2) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives (CLOs):
1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):
1. Able to study the concept of renewable and non-renewable sources.
2. Apply the basic concept of solar energy utilization and storage.
3. Apply the concept of energy from ocean and wind.
4. Study the concept of bio-mass energy resources.

UNIT I :

1. Introduction:- Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,

2. Solar Radiation: Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II :

1.Solar thermal systems : Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants. Solar energy storage and utilization: Methods of storage- mechanical, thermal, electrical storage systems.

2. Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV; Brief outline of solar PV stand-alone system; Storage battery and Balance of system.(8 Hrs)

Unit III :

Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Wind pattern and wind speed data, Types of turbines, Coefficient of Power, Betz limit. Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. Application for pumping (7 Hrs.)

Unit IV :

Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems.

Biogas-Types of bio gas plants, factors affecting production rates. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V : **Energy from Ocean:** Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Wave energy and power from wave, wave energy conversion devices, advantages and dis-advantages of wave energy (7 Hrs.)

UNIT VI : Fuel Cells: Introduction, working principle of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

Hydrogen Energy: Hydrogen as alternative fuel, Production methods, Hydrogen storage, **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. **(8Hrs)**

Books Recommended:

TEXT BOOKS:-
1. Solar Energy, S.P.Sukhatme, TMH.
2. Non-Conventional Energy Sources, G.D.Rai, Khanna Publications.
3. Non-Conventional Energy Sources, B. H. Khan

REFERENCE BOOKS:-
1. Treatise on Solar Energy : H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage, Bent Sorenson; Elsevier Publication
3. Renewalle Energy; GodfreyBoyle, Oxford University Press, Mumbai.

6ME04 PROFESSIONAL ELECTIVE-I
(3) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives (CLOs):
1. To study product cycle & fundamentals of CAD/CAM.
2. To understand the concept of representations of curves and surfaces.
3. To study the solid modeling techniques.
4. To study the geometric transformation techniques.
5. To study basic probability & statistics and physical modeling.
6. To study Simulation of Mechanical Systems & Simulation of manufacturing systems.

Course Outcomes (COs):
1. Understand the concept of CAD/ CAM and CIM .
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Unit I: Fundamentals of CAD/CAM:
Product cycle and scope of CAD/CAM/CIM in product cycle, CAD/CAM, Hardware and software, selection of software, CAD workstation configurations. (6 Hrs)

Unit II: Representations of curves and surfaces:
Introduction to analytical curves, synthetic curves: Hermite cubic Spline, Bezier Curve, B- Spline curve. Surface Representation : Synthetic Surfaces, Applications of surface modeling. (6 Hrs)

Unit III: Solid Modeling :
2D Vs 3D modeling, Comparison of Wireframe, surface and solid modeling techniques, Geometry Vs Topology, Requirements of Solid Modeling Methods: Constructive Solid Geometry (CSG), Boundary Representation (B-rep), etc. (6 Hrs)

Unit IV: Geometric transformation
2D geometric transformations, Homogeneous co-ordinate representation, Composite Transformations, 3D transformations, Inverse transformations, geometric mapping. (8 Hrs)

Unit V: Introduction to statistics and physical modeling: A review of basic probability and statistics, random variables and their properties , Estimation of means variances and correlation. Physical Modeling- Concept of System and environment, Principles of modeling, types of models. (8Hrs)

Unit VI: Simulation of Mechanical Systems: Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation Simulation of manufacturing Systems: Introduction to Flexible manufacturing systems, Simulation software for manufacturing. (8 Hrs)

Books Recommended :

Text Books:
1) P. N. Rao; CAD/CAM Principles and Applications; McGraw Hills Publications.
2) Mikel P. Groover and Emory W. Zimmers: Computer Aided Design and Manufacturing, Prentice hall.
3) Ibrahim Zeid: Mastering in CAD- CAM, Tata McGraw Hill Publication.
4) Geoffrey Gordon, System Simulation; Prentice Hall

Reference Books:
1) Mikell P. Groover: Automation, Production systems & Computer Integraded manufacturing, Prentice Hall.
2) Robert E. Shannon; System Simulation: The Art and Science ; Prentice Hall
3) J. Schwarzenbach and K.F. Gill Edward Arnold; System Modelling and Control
4) P. Radhakrishnan and Subramaniam: CAD/CAM/CIM, wiley Eastern Ltd.

6ME05 OPEN ELECTIVE -II
(1) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives(CLOs):
1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):
1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

UNIT I :
1. **Introduction:-** Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,
2. **Solar Radiation:** Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II: Solar thermal systems. Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants.

Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV ; Brief outline of solar PV stand-alone system ; Storage battery and Balance of system. (8 Hrs)

Unit III : Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Types of turbines, Coefficient of Power, Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. (7 Hrs.)

Unit IV : Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants ; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V : **Energy from Ocean:** Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. **Ocean Thermal Electric Conversion** (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India.

Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy. (7 Hrs.)

UNIT VI:

1. **Fuel Cells :** working principle, types of fuel cells, applications.
2. **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. (8Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Solar Energy; S.P. Sukhatme; TMH
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications
3. Non-Conventional Energy Sources; B. H. Khan.

Reference Books:

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; BentSorensen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI

6ME05 OPEN ELECTIVE-II (2) AUTOMOBILE ENGINEERING

Course Learning Objectives:

1. To study the Introduction of automobiles, engine types and working of SI and CI engines.
2. To study the fuel feed systems, their types and to understand the basics of cooling system.
3. To study the electrical system, Battery capacity and its ratings, starter motor drive and to understand the basics of Ignition system.
4. To study the basics of transmission system, clutches, gear boxes and to understand the principle of differential.
5. To study the braking system, steering system, wheel balancing and alignment and to study the introduction of power steering.
6. To study the basics of suspension system, shock absorbers and to study the types of lubricants and lubrication system, crankcase ventilation.

Course Outcomes (COs):

1. Understand the basics of automobile engineering and its components.
2. Analyze &develop about the cooling system and its function.
3. Understand basic concept of transmission system and types of gears box, basic concept of electrical system and ignition system.
4. Apply the knowledge of suspension and lubrication.

UNIT I : Introduction, Classification of automobiles, chassis layout, basic working of SI and CI engines, engine parts, engine types, Multiple cylinder engines. (7 Hrs)

UNIT II : Fuel feed systems- fuel feed systems for petrol and diesel engines, Basic principles of Multipoint Fuel Injection Systems(MPFI) and Common Rail Diesel Injection Systems(CRDI). Cooling system: purpose, Air cooling and liquid cooling system, radiator, by pass recirculation system, antifreeze mixtures. (7 Hrs)

UNIT III : The electrical system. Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Ignition system:- Battery coil ignition system, Electronic ignition system. (7 Hrs)

UNIT IV: Transmission system:- Layout, Working principle of clutch, single plate friction clutch and multiplate clutch, Gear Boxes:- Sliding mesh, constant mesh gear box, Propeller shaft, Hotchkiss drive, torque tube drive, differential. (8 Hrs)

UNIT V: Braking system: Mechanical, hydraulic brakes, power brakes and vacuum brakes. Steering system:- Function, types of linkages, steering gears, wheel balancing, wheel alignment, camber, castor, king pin inclination, toe-in& toe-out & their effects, Introduction to power steering. (7 Hrs)

UNIT VI: Suspensions : shock absorbers, Rigid axle and independent suspension system, Auto lubrication :- Types of lubricants, their ratings, multi viscosity oils. Engine lubrication:- types of lubricating systems, full pressure system, dry sump system, crankcase ventilation. (6Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
2. Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi

Reference Books:

1. Automotive Mechanics; Crouse & Anglin; TMH.
2. Automotive Mechanics; J. Heitner; East West Press
3. Automotive Mechanics; S. Srinivasan; TMH.

6ME06 DESIGN OF MACHINE ELEMENTS - LAB.

Course learning objectives:

1. To study the basic design principles
2. To familiarize with use of design data books & various codes of practice
3. To make conversant with preparation of working drawings based on designs

Course Outcomes: After successfully completion of this course students will be able to:

1. Design various machine elements like joints, springs, couplings etc, under various conditions
2. Convert design dimensions into working/manufacturing drawing
3. Use design data book/standard codes to standardize the designed dimensions

Practical Term Work: At least Six exercises based on the following:

1. Design of Cotter or Knuckle joint.
2. Design & drawing of screw jack.
3. Design & drawing of Riveted joints.
4. Design & drawing of leaf spring.
5. Design of shaft on the basis of various loading.
6. Design and drawing of Coupling (any one type).
7. Design and drawing of Journal Bearing Plumber Block Type).
8. Design and drawing of connecting rod in IC Engine.
9. Design and drawing of Flywheel.
10. Determine Hydrodynamic lubrication profile using Journal Bearing Apparatus.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME07 DYNAMICS OF MACHINES- LAB.

Course Learning Objectives:

1. To understand Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic couple and its effect.
3. To understand the phenomenon of vibrations.
4. To demonstrate the effect of static and dynamic balancing.

Course Outcomes:

Students will be able to :

1. Apply basic concept of force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of vibrations.
5. Analyze the concept of balancing of machinery.

Practicals:- At least eight practical from the following list:

1. Study of static force analysis of mechanism. (any 2 problem)
2. Determining the inertia forces of connecting rod
3. Determination of gyroscopic couple using motorized gyroscope .
4. Study of vehicle dynamics.
5. To study the longitudinal vibration of helical spring and to determine the frequency and time period of oscillation theoretically and experimentally.
6. Experiment on free and damped vibration of systems with one degree of freedom.
7. Experiment on forced damped vibration of systems with one degree of freedom.
8. Experiment on free damped torsional vibration.
9. To verify the Dunkerleyös rule.
10. To determine the natural frequency of free torsional vibration of single rotor system.
11. To determine the natural frequency of free torsional vibration of two rotor system.
12. Experiment on whirling speed of shaft.
13. Experiment on static balancing of rotating masses.
14. Experiment on dynamic balancing of rotating masses.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I - LAB (i) TOOL ENGINEERING –LAB.

Course learning objectives:

1. To study the basic geometries of different cutting tools
2. To study cutting forces involved in machining operation using tool dynamometer.
3. To understand the steps involved in designing and drawing of various tools.
4. To understand the design and operation of various types of Jigs and Fixtures.

Course Outcomes: On completion of this course students will be able to :

1. Create the design of single and multi-point cutting tools.
2. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
3. Analyze the real time problems of work holding by designing jigs and fixtures.

TERM WORK: (Any Six of the following)

1. Design & Drawing of single point cutting tool.
2. Design & Drawing of Form Tools (Using Graphical Method).
3. Measurement of forces in Orthogonal cutting by Lathe Tool Dynamometer.
4. Measurement of forces & Torque in Drilling by Drill Tool Dynamometer.
5. Study of geometric Elements & Forces in Multi-Point Cutting Tool. 6. Design & drawing of Post Drill Jig.
7. Design & Drawing of Turnover Drill Jig.
8. Design & Drawing of Milling Fixture.
9. Design & Drawing of Turning Fixture.
10. Design & Drawing of Compound Die.
11. Design & Drawing of Progressive Die.
12. Design & Drawing of Drawing die.

Practical Examination : Practical exam shall consist of viva-voce based on the term work and theory syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(2) NON-CONVENTIONAL ENERGY SOURCES–LAB.

Course Learning Objectives (CLOs):
1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):
1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

List of practicals : Any six practicals will be based on the following topics :-
1. Study of Pyrheliometer and measurement of direct radiation.
2. Study of pyranometer and measurement of global and diffuse radiation.
3. Study of sunshine recorder and measurement of sunshine hours.
4. Study and testing of a flat plate recorder.
5. Study of biogas plant.
6. Study of photovoltaic system,
7. Study of various types of Wind mill.
8. Study of various solar equipment.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(1) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives (CLOs):
1. To understand fundamentals of CAD.
2. To study the solid modeling techniques.
3. To study the geometric transformation techniques.
4. To demonstrate Simulation of Mechanical Systems.

Course Outcomes (COs):

1. Understand the concept of CAD.
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Practicals:- Any six practicals from the list should be performed.

1. Creation of 2D drawing (Sketching Module) of any mechanical machine component using any modeling/drawing software.
2. Creation of isometric view from given orthographic view of any mechanical machine part using any modeling software.
3. Creation of 3D drawing of any mechanical machine part using any modeling software.
4. Creation of assembly of Knuckle joint/ Cotter joint using any modeling software.
5. Creation of sheet metal component using any modeling software.
6. Simulation of Four bar chain mechanism using any modeling software.
7. Simulation of Slider crank chain mechanism using any modeling software.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME09 RESEARCH SKILLS – LAB

Course learning objectives:

1. Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
2. Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
3. Use effectively oral, written and visual communication.
4. Identify, analyze, and solve problems creatively through sustained critical investigation.
5. Integrate information from multiple sources.
6. Demonstrate an awareness and application of appropriate personal, societal, and professional ethical standards.
7. Practice the skills, diligence, and commitment to excellence needed to engage in lifelong learning.

Course Outcomes:

1. Demonstrate a sound technical knowledge of their selected research topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach.
4. Conduct an engineering research.
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Students will have to perform any one task and prepare a report on it; from the following list:

1. A mini project involving mechanisms/ electromechanical systems/
2. CAD modeling/ simulation of any thermal, hydraulic or mechanical system.
3. IoT based system for any domestic/ rural/ agricultural/ industrial application
4. A system using non- conventional energy source
5. Market research for launching a new product.
6. Study of any Small Scale Industry.
7. Any other innovative concept for promoting research and innovation among students.

***Practical Examination:-** The practical examination shall consist of oral basedon the task and the report.

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SEMESTER V & VI B.E. ELECTRICAL, ELECTRICAL (ELECTRONICS & POWER) AND ELECTRICAL & ELECTRONICS

B.E. (ELECTRICAL ENGG.) SEMESTER - V

5EE01 CONTROL SYSTEMS

Course Outcomes:

After completing this course, the students will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I: Introduction to automatic control : Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components:

Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis:

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability:

Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods

Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response

Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

Books Recommended:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai &Co.

5EE02 MICROPROCESSOR & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to:

1. Recite Fundamentals and Architecture of Microprocessor 8085, Microcontroller 8051
2. Interpret Assembly Language Programming of Microprocessor 8085, Microcontroller 8051
3. Illustrate interfacing with Microprocessor 8085, Microcontroller 8051
4. Develop applications of Microprocessor 8085, Microcontroller 8051.

Unit I : 8085- architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings.

Unit II : Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085, Data transfer schemes, serial data transfer through SOD and SID line.

Unit III : Programmable Interfacing devices: Internal architecture, programming and interfacing of Programmable Peripheral Interface PPI (8255), Programmable Interrupt Controller PIC (8259),Universal Synchronous Asynchronous Receiver Transmitter USART (8251) and Programmable Interval Timer PIT(8253)

Unit IV: Introduction to microcontroller: 8051 pin configuration and architecture, 8051 Internal resources, pin diagram, I/ O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.

Unit V: Instruction set of 8051. Addressing modes. Various groups of instructions: data transfer. Arithmetic- logical group. Interrupt, timer counter related instructions. Interfacing of 8051with external memories. Programming 8051 with interfacing examples**.**

Unit VI: 8085 Microprocessors / 8051 Microcontroller Applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of Pulse width and Magnitude using 8085. Measurement of fundamental quantities -voltage, current, frequency, speed using 8051 Microcontroller.

Text Books:

1. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar PHI Publication-2006
2. The 8051 Microcontroller and Embedded SystemsMazidi, J.GMazidi, Mckinlay , Pearson Ed.

Reference Books:

1. An Introduction to Microcomputers, Adam Osborne Osborne-Mc-Graw Hill,
2. Advance Microprocessor and Peripherals, K.M.Bhurchandi & A.K.Ray, TMH, 2006.
3. Subrata Ghoshal ñ8051 Microcontrollerò Pearson Education.
4. Richard Barnett , The 8051Family of Microcontrollers Prentice-Hall, Inc-2000

5EE03 ELECTRICAL MACHINES –II

Course Outcomes:

After completing this course students will be able to:

1. Describe the construction, working operation & performance characteristics of the three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single ï phase Induction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor.

Unit I: Three phase induction motor-I:

Construction, Types (squirrel cage and slipring), Rotating Magnetic Fields, Principle ofoperation, Torque Slip Characteristics, Starting and Maximum Torque.Effect ofparameter variation on torque slip characteristics. Equivalent circuit, Phasor Diagram, Performance evaluation bydirect& indirect testing,circle diagram.

Unit II : Three phase Induction Motor (IM) –II:

Starters for squirrel cage & slip-ring type IM, Methods of speed control, electric braking,High Torque IM, single phasing, cogging and crawling, Doubly-FedInduction Machines.

Unit III: Single phaseInduction Motor:

Double revolving field theory, Constructional features, equivalent circuit, working, Split-phasestarting methods and applicationsof single-phaseInduction motors.

Unit IV: Synchronous Generator:

Constructional details, working principle, operation, armaturereaction, circuitmodel, determinations of parameters of the circuit model and phasordiagram, methods of determining the regulations and efficiency, Parallel operation of alternators-Synchronization.

UnitV: SynchronousMotor:

Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve &power angle characteristics, hunting & damping, applications. Transient, subtransient & steady state reactanceofsynchronous machines.

Unit VI: Special Motors:

Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari & I.J.Nagrath,ñElectrical Machinesò-5thEdition, TMH Publication.
2. S.Langsdorf,ñAlternating Current Machinesò, Mc-Graw Hill Publication.

Reference Books:

1. Fitzgerald and Kingsleyôs Electric Machineryò, 7th Edition, McGraw Hill.
2. M.G.Say,ñPerformanceanddesignofACmachinesò,CBSPublishers, 2002.
3. P.S.Bimbhra,ñElectricalMachineryò, KhannaPublishers,2011.
4. C L Dawes, ñA Course in Electrical Engineering (Volume -2)ò, McGraw Hill.

5EE04 Professional Elective-I : POWER SYSTEM OPERATION AND CONTROL

Course Outcomes:

After completing this course student will be able to:

1. To impart knowledge to describe, calculate and analyze energy generation, unit commitment problem in thermal power plant, power system behavior and economics of generating costs.
2. To understand and analyze optimal dispatch with transmission losses, penalty factor and automatic load dispatch.
3. To learn the concept of real and reactive power flow and its control in power system.
4. To learn the automatic voltage regulator and automatic load frequency control.
5. To learn tie line interchange between interconnected utilities.
6. To illustrate various ways of interchange of power between interconnected utilities.
7. To impart knowledge about various advanced controllers such as FACTs controllers with itsevolution, principle of operation, circuit diagram and applications

Unit I : **Economic Operation – Part I:**
Meaning of optimum scheduling, UCP and LSP; Input ï Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Unit II : **Economic Operation – Part II**
Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

Unit III : **A. Generator Control Loops**
Concept of real and reactive power; Effect of real and reactive power on system parameters; Basic generator control loops.

B. Automatic Voltage Regulator (AVR)
Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Unit IV : **Automatic Load Frequency Control**
Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

Unit V : **Control Area:** eaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ï Dynamic response; Tie-line bias control.

Unit VI : **Energy Control of Power System :** Interchange of power between interconnected utilities, economy interchange evaluation, interchange evaluation with unit commitment, types of interchange, capacity and diversity interchange, energy banking, emergency power interchange, inadvertent power exchange, power pools, Circuit diagram and applications of FACTs Technology :- SVC, TCSC, STATCOM and UPFC.

Text Books :-

1. O. L. Elgerd Electric Energy Systems Theory: An Introduction ï 2nd edition, McGraw -Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.

Reference Books :

1. L. K. Kirchamayor ï Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ï Power System Analysis ï WCB/McGraw-Hill International Edition 1999
3. I.J. Nagrath, D. P. Kothari ï Modern Power System Analysis ï Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ï Power System Operation and Control ï Tata Mc-Graw Hill Publishing Company, New Delhi.

5EE04 Professional Elective – I
ELECTRICAL ENGINEERING MATERIAL

Course Outcomes:

After completing this course student will be able to :

1. Understand importance of electrical engineering materials
2. Understand how electric conduction takes place in conductors
3. Understand importance of semiconductors and magnetic materials in electrical engineering.
4. Understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials: Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials. Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials: Review of metallic conduction on the basis of free electron theory. variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder.

Unit-III Semi conductors: Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials:
Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays. Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Anti ferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.
Unit-V Dielectrics & Insulating Materials: Dielectrics, Factors influencing dielectric strength. Capacito rmaterials. Insulating materials. Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.
Unit-VI Materials For Special Applications: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text Book: Electrical Engineering Materials by Dekker A.J (PHI)
Reference Books:

1. S.P.Seth Electrical Engineering Materials (Dhanpat rai and Sons)
2. C. S Indulkar & S. Thiruvelgadam, an Introduction to Electrical Engineering Materials (S Chand Publication)

5EE04 Professional Elective – I
ELECTRONIC COMMUNICATION THEORY

Course Outcomes:
After successfully completing the course, the students will be able to:
1. Explain various types of signal & elements of communication system.
2. Analyze the signal using Fourier Transform
3. Apply Amplitude modulation & Frequency modulation on the communication signal
4. Compare Pulse communication & Digital communication
5. Describe microwave communication system

Unit I: Introduction to Electronics Communication Systems:
Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & nonperiodic, Elements of Communication Systems, Transmitter, Receiver, Need for Modulation, band width requirements, Noise, External, internal noise, noise calculation, noise figure.
Unit II : Signal Analysis:
Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.
Unit III: Amplitude Modulation
Amplitude Modulation Theory, Generation of Amplitude Modulation, Single Side band Communication, suppression of carrier, suppression of unwanted side band, AM receiver.
Unit IV: Frequency Modulation:
Theory of Frequency Modulation, characteristics of FM, Generation of FM, pre-emphasis, De-emphasis,wide &Narrow band FM Transmission, FM receiver.
Unit V: Pulse Communication :
Information Theory, Classification of pulse modulation, Sampling process, pulse amplitude modulation, PWM and PPM modulation pulse co-demodulation.
A: Digital Communication:
Fundamentals of data communication systems, data sets and inter-connection requirements.
Unit VI: Microwave communication system:
Analog microwave communication: LOS, OTH microwave system Satellite communication: Satellite orbits, frequencies, attitude, transmission path.
Text Book: Electronic Communication System by Kennedy, Davis,TMH.
Reference Books:
1. Electronics Communication by K.Shoenbcle PHI, India.
2. Electronics Communication Techniques, Paul Young,Willey Eastern Pub.
3. Principle of Communication Engineering, Taub Schilling. TMH.
4. Electronics Communication ï Robert Shrader Mc-Graw Hill.

5EE05 Open Elective – I POWER PLANT ENGINEERING

Course Outcomes:-
1) Describe different Sources of Energy Generation.
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction:

Energy resources and their availability, types of powe rplants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro-Electric Power Plant:
Rainfall and run-off measurements and plotting of various curves for estimating stream flow andsize of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection,advantages & disadvantages
Unit-III: Steam Power Plants:
Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant, Site selection, coal storage, coal handling systems, ash Handling systems, working of various parts: Economizer, air pre-heater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages.
Unit-IV: Nuclear Power Plants:
Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working ofNuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANadaDeuterium- Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.
Unit-V: Diesel & Gas power plant:
Layout of Diesel power plant, functions of different components of diesel plant, advantages &disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closedcycle gas power plant, Combined gas and steam cycle.
Unit-VI: Power Plant Economics:
Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives/Types of Tariff,

Text Books:
1. Generation of Electrical Energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineering; R.K.Rajput; Laxmi Publications.

Reference Books:
1. Non-Conventional Energy Resources by G.D.Rai, Khanna Publishers, New Delhi.
2. Principles of PowerSystem byV.K.Mehta, S.Chand Publication.
3. Conventional energy technology by S.B.Pandya,Tata Mc-Graw Hill Publication.
4. Power Plant Engineering, P.K.Nag.

5EE05 Open Elective - ELECTRICAL DRIVES

Course Outcomes:

After completing this course, Students will be able to:
1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Industrial Applications
3. Demonstrate various starting, braking and speed control methods of DC Motor Drivs
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor & special motors

Syllabus:

Unit I: Electric Drive: Concept, classification, parts, and advantages of electrical dives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Multi quadrant operation of drives. Load equalization.
Unit II: **Motor power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.
Unit III: Starting & Braking of Electric Drives: Effect of starting on Power supply, motor and load. Methods of starting of electric motors. Acceleration time Energy relation during starting, methods to reduce the Energy loss during starting. Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking.
Unit IV: **DC motor drives:** Modeling of DC motors, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current, Chopper controlled DC motor drives.
Unit V: Induction motor drives: Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed induction motor drive. Volts / Hertz Control.

Unit VI: Industrial applications of Electric Drives: Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive Industrial application: Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.

Text Books:
1. Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.
2. A first course on Electrical Drives, S.K. Pillai, , New Age International Publication.

Reference Books:
1. Electric Drives, Vedam Subrahmanyam, TMH
2. Bose, B.K., Modern Power Electronics and AC Drives, PHI
3. Electric Motor Drives, R. Krishnan, PHI
4. Sen, P.C., Thyristor DC Drives, John Wiley and Sons (1981).

5EE06 CONTROL SYSTEM - LAB

Student should perform minimum eight practicals based on the followings.

List of Experiments :
1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination of Frequency Response of Given R-C Network
7. Determination of Transfer Function of A.C. Tacho-Generator
8. Experimental Study of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

Note : Above experiments may be conducted by using models, simulation, numerical, drawing sheets or experimentation.

5EE07 MICROPROCESSOR &MICROCONTROLLER- LAB

List of Experiments:
1. Write an Assembly Language Program for the Addition of two8-bit/16-bit numbers
2. Write an Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8-bit numbers
4. Write a Program for Finding the largest/smallest number in array of 8-bit numbers
5. Write a Program for Masking and setting of nibbles
6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085/8051 using 8255 PPI
12. Write a Program for Interfacing DAC with 8085/8051 using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC Voltage /Current using ADC, 8255 PPI
15. Study of Architectural Differences: Microprocessor 8085, and Mcrocontroller 8051

5EE08 ELECTRICAL MACHINES - II LAB.

List of Experiments :
1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three ï phase alternator within finite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V& inverted V curves of synchronous motor.

5EE09 INFORMATION &COMMUNICATION TECHNOLOGY - LAB

Word Processing with MS-Word:
- Basic operations- Editing and Formatting text, paragraphs and pages, printing.
- Working with tables, figures, images.
- Mailmerge.Working with Charts, Equations, Symbols.

MS Excel: Working with work books / work sheets.

- Data Entry techniques & defining datas etasa Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting / Filtering data in excel sheet.

Working with MS Power Point.

- Presentation Basics. Adding more components to the slides, printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using SlideMaster.
- Working with Graphics, Images and Clips. Multimedia. Inserting Sound and Narration
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving / Protecting the Presentation.

Web Page Development:

- Introduction to HTML, CSS, JAVA Scripting
- Development of Webpage.

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SEMESTER : VI [ELECTRICAL ENGINEERING]

6EE01 POWER ELECTRONICS

Course Outcomes

After completing this course student will be able to

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC converter circuits
6. Demonstrate the applications of power electronic circuits.

Syllabus

Unit I:SCR, Triac, Diac ï Construction and Applications, two Transistor Analogy of SCR, SCR turnON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage/ over-current protection.

Unit III: Principle of phase control, half-wave-controlled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Book: Rashid Muhammad, H., ñPower Electronics: Circuits, Devices and Applicationsò, 4th Edn., Pearson Education.

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., ñPower Electronics: Converter, Applications and Designò, John Wiley & Sons, 1994.
2. LandevCyrill, W., ñPower Electronicsò, McGraw Hills, London, 1981.
3. Dewan, S.B. and Satrughan A., ñPower Semiconductor Circuitsò, John Wiley & Sons,
4. M.D. Singh & K.B. Khanchandani, ñPower Electronics ñTata Mc-Graw Hill, New Delhi

6EE02 POWER SYSTEMS -II

Course Outcomes:

At the end of the course, students will be able to:

1. Understand Power Factor improvement, Capacitor bank installation in distribution system, metering system in Industries and Residential area.
2. Understand Positive Sequence, Negative & zero sequence system and fault analysis.
3. Create computational models for analysis of both symmetrical and unsymmetrical conditions in power systems,
4. Analyse the system performance where there is an unbalanced fault, and also calculate the corresponding fault current.
5. Examine the need of various analysis like fault analysis, short circuit analysis stability analysis, steady state and transient analysis.

Syllabus :

Unit I : Symmetrical Components : Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank-sequence voltages and currents relationship.

Unit II: Power system elements ï sequence impedance and sequence networks ; Various three phase transformer connections ï zero sequence rules; Unbalanced load system - Power Factor improvement, Capacitor bank installation in distribution system, Metering system in Industries and Residential area

Unit III : Symmetrical Fault Analysis : Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

Unit IV : Unsymmetrical Fault Analysis:L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults- loaded and unloaded conditions.

Unit V : Over voltages : Causes ï internal and external; Voltage surge, Basic insulation level, Protection ï earthing screen, overhead ground wire, lightning arresters.

Unit VI : Corona Effect : Power loss due to corona, Practical importance of corona, use of bundled conductors in E.H.V transmission lines and its advantages, Overhead line insulators ,Voltage distribution in suspension type insulator, String efficiency , Grading . Sag and stress calculation of overhead conductance, Vibration dampers.

Text Book :- 1. Power System Analysis, N.V.Ramana, Pearson Education, 2010.

Reference Books:

1. Power System Analysis, Arthur R. Bergen, Vijay Vittal,2/e, PEARSON Education
2. I. J. Nagrath & D. P. Kothari ï ñModern Power System Analysisò, TMHPublishing.
3. Depriya Das, Electrical Power System

6EE03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcome

After completing this course, student will be able to

1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Syllabus

Unit I: Introduction: Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD.

Unit II: Transformer Design -I: Transformer Core Design - Material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, Minimum losses, Minimum weight & Minimum volume.

Unit III: Transformer Design – II: Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces ï types & causes. Estimation of efficiency & regulation from design data. Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC Winding Design: Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction Motor Stator design: Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot- numbers, shape and dimensions, stator teeth dimension, stator core dimensions.Air gap length calculation.

Unit VI: Induction Motor Rotor design::Squirrel cage rotor design ï selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design -** rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:

1. A. K. Sawhney, ñA Course in Electrical Machine Designò Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, ñPrinciples of Electrical Machine Designò, S.K.Kataria and Sons, Delhi

Reference Books:

1. K.G.Upadhyay,ñDesign of Electrical Machinesò, New Age international Publishers,1st Edition 2008
2. S.K.Sen,ñPrinciples of Electrical Machine Design with Computer Programsò, Oxford and I.B.H. Company Pvt. Ltd., New Delhi
3. IndrajitDasgupta, ñDesign of Transformersò, TMH 1st Edition 2002
4. Indian Standards for Transformer & Three phase IM design from BIS websites

6EE04 Professional Elective - II
ADVANCED CONTROL SYSTEMS

Course Outcomes:

After completing this course students will be able to:

1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems.
4. Design state feedback controller.
5. Analyze digital systems using Z Transform
6. Develop the describing function for the nonlinearity to assess the stability of the system.
7. Analyzethe Nonlinear system using Phase plane Analysis

Syllabus :

Unit I: Compensation Techniques :

Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead-Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I: State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition ï Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response ï SISO systems.

Unit III: State Space Technique II:

Concept-controllability and observability, SISO/ MIMO linear Systems Gilbertôs method and Kalmanôs test; SISO controllable Systems design ï state feedback.

Unit IV: Sampled Data Control Systems:

Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Juryôs test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I:

Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: **Non-Linear System Analysis II**:
Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction ï analytical and graphical method by isoclines, stability analysis, limit cycles, limitations ï phase plane method.

Text Books:
1. Nagrath and Gopal,ò Control system Engineeringò Wiley Eastern Ltd , New Delhi
2. K.Ogata,ò Modern Control Theory ñPrentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:
1. Naresh Sinha. ñControl system Engineeringò Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. ñAutomatic Control systemò Prentice Hall Of India Pvt Ltd Delhi.
3. D Roy Choudhury, ñModern Control EngineeringòPublisher: PHI Learning.

6EE04 Professional Elective – II:
DIGITAL COMMUNICATION SYSTEMS

Course Outcomes:
After Completing this course student will be able to:
1. To study basic building blocks of digital communication system.
2. To learn information theory and theoretical bounds on the data rates of digital communication.
3. To understand and analyze communication channel.
4. To study and analyze different digital modulation techniques.
5. To study baseband transmission of the signal.
6. To understand importance of channel encoding and decoding in digital communication.
7. To study multiple access schemes and spread spectrum communication.

Unit-I: Introduction to Digital Communication SYstem: Functional Blocks of Digital Communication System; Source Encoder and Decoder, Channel Encoder and Decoder, Modulator and Demodulator. Line Coding: Need for Line coding, Properties of Line Coding, Unipolar RZ and NRZ, Polar RZ and NRZ, Bipolar NRZ (AMI), Split Phase Manchester Coding, Polar Quaternary NRZ Coding, HDB3 Coding, Scrambler and Unscrambler.

Unit-2: Information Theory:
Measure of Information, Entropy and Information Rate of Long Independent and Dependent Sequences. Source Encoding: Huffman Encoding, Shannonõs Encoding Algorithm, Shannon- Fano Algorithm. Discrete Communication Channel: Noiseless Channel, Deterministic Channel, Binary Symmetric Channel, Rate of Information Transfer over Discrete Channel, Capacity of Discrete Memoryless Channel.Continuous Channel: Shannon Hartley Theorem for channel capacity, Signal to Noise Ratio ï Bandwidth Tradeoff.

Unit-3 : Bandpass Modulation and Demodulation techniques:
BPSK, BFSK, ASK and DPSK generation and reception, Signal space diagram, PSD and Bandwidth of BPSK and BFSK systems, QPSK. Transmitter and Receiver, Signal space diagram, PSD and Bandwidth of QPSK, Probability of Error of ASK, BPSK and BFSK systems, Comparison of Digital modulation systems. Coherent Detection: Matched Filter (Impulse response and Probability of Error).

Unit-4: Base Band Transmission:
Base Band Binary PAM systems, Inter Symbol Interference, Base Band Pulse Shaping and Nyquist Criterion, Eye Diagram, Correlative Coding: Duobinary Encoder with Pre-coder, Modified Duobinary Encoder, Modified Duobinary Encoder with Pre-coder. Equaliation: Need for equalization, Transversal Equalizer (Problems Expected), Preset Equalizer, Adaptive Equalizer, Clock and Carrier Synchronization.

Unit 5: Error Control Coding:
Introduction to Error Control Coding, Types of Errors, Methods of Controlling Errors, Linear Bloc Codes:Matrix Description of Linear Block codes, Hamming Distance, Hamming Weight, Minimum Hamming Distance, Hamming Codes, Encoder for Linear Block code, Syndrome Decoding, Syndrome Decoder for (n, k) Linear Block Code, Error Detection and Correction capability of Linear Block Codes (Derivation expected). Cclic Codes: Properties of Cyclic Codes, Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes, Encoders for Cyclic Codes, Syndrome Decoding for Cyclic Codes. Convolution Codes:Time Domain Approach and Transform domain approach for convolution code generation, Code Tree and Code Trellis for Convolution code.

Unit 6: Multiple Access Schemes and Spread Spectrum Communication:
Multiple Access schemes: Time Division Multiple Access, Frequency Division Multiple Access, Code Division Multiple Access, Space Division Multiple Access. Spread Spectrum Sytems: Notion of Spread Spectrum, PN Sequence Generation (Problems Expected), Direct Sequence Spread Spectrum (DSSS), Jamming Margin, Processing Gain, Eb/No Ratio, Frequency Hopped Spread Spectrum, Slow and Fast frequency Hopping

Text Book: Proakis J. K., ñDigital Communicationò, Mc-Graw Hill Book Co., London (Second Edition)

.**Reference Books:**

1. Shanmugam K.S., ñDigital & Analog Communication Systemsò, John Wiley & Sons, New York, 1996
.2. Taub, Herbert, Schilling D. L., ñPrinciples of Communication Systemsò, Mc-Graw Hill International Book Co., Tokyo.
3. W.C.Y. Lee, ñMobile Cellular Telecommunications Systemsò, Mc-Graw Hill International Editions, 1990.
4. Glover and Grant, ñDigital Communicationò, Prentice Hall Publication.

6EE04 Professional Elective – II
INDUSTRIAL ELECTRICAL SYSTEMS

Course Outcomes:
At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components:
LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse currentcharacteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator,Relays, MPCB, Electric shock and Electrical safety practices

Unit 2: Residential and Commercial Electrical Systems:
Types of residential and commercial wiring systems, general rules and guidelines forinstallation, load calculation and sizing of wire, rating of main switch, distribution board andprotection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit 3: Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency,specific consumption, glare, space to height ratio, waste light factor, depreciation factor,various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED andtheir operation, energy saving in illumination systems, design of a lighting scheme for aresidential and commercial premises, flood lighting.

Unit 4: Industrial Electrical Systems – I:
HT connection, industrial substation, Transformer selection, Industrial loads, motors, startingof motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design,Power factor correction ï kVAR calculations, type of compensation, Introduction to PCC,MCC panels.Specifications of LT Breakers, MCB and other LT panel components.

Unit 5: Industrial Electrical Systems – II:
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing theDG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit 6: Industrial Electrical System Automation:
Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distributionautomation.

Text Book: S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers.
Reference Books:

1. K. B. Raina, ñElectrical Design, Estimating & Costingò, New age International, 2007.
2. S. Singh and R. D. Singh, ñElectrical estimating and costingò, Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, ñResidential Commercial and Industrial Systemsò, McGraw Hill Education, 2008.

6EE05 OPEN ELECTIVE – II
ENERGY AUDIT AND MANAGEMENT

Course Outcomes:
After completing this course student will be able to:

1. Discuss energy scenario and itꞌs management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discussvarious energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Syllabus:

Unit I : Energy Scenario & Management:

Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:

Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energyð production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:

Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:

Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:

Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:

Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions-active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference: Books:

1. S. C. Tripathy, ñUtilization of Electrical Energy and Conservationò, McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press
4. Energy Audit and Conservation TERI.

6EE05 Open Elective – II
ELECTRICAL ESTIMATING & COSTING

Course Outcomes:

After completion of the course students will be able to

1. Understand methods of installation and estimation of service connection
2. Decide type of wiring, its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Syllabus:

Unit I: Electrical Installation:

Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation.

Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection.Estimation of service connection.

Unit II : Residential Building Electrification :

Procedures for designing the circuits and deciding the number of circuits.Selection of type of wiring and rating of wires &cables..Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III:Electrification of commercial Installation:

Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:

Concept of Industrial load. concept of Motor wiring circuit.Important guidelines about power wiring and Motor wiring.Selection and rating of wire, cable size.Sequence to be followed to prepare estimate.Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:
Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI:Contracts, Tenders and Execution:
Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technicalsanctions.Billing of executed work.

Text Book: Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.

Reference Books:
1. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi.
2. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6EE06 POWER ELECTRONICS - LAB.

List of Experiments:
1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EE07 POWER SYSTEMS - II LAB

List of Experiments:

1. Determination of negative sequence reactance of a synchronous generator
2. Determination of zero sequence reactance of a synchronous generator
3. To study various types of current limiting reactors
4. To study the mechanism of lightning arrester
5. Introduction to use of Simulation package (Power World Simulator) for power systems
6. To study substation layout and its components
7. To study HVDC Transmission System
8. To simulate three phase fault for a given power system using MATLAB Simulink
9. To find the direct axis synchronous reactance, X_d& quadrature axis synchronous reactance, X_q of a salient pole synchronous machine by slip test
10. To find the direct axis subtransient reactance, X_dò & quadrature axis sub ïtransient reactance, X_qò of a salient pole synchronous machine by conducting static test
11. TO study of corona on EHV lines.
12. To study of faults at overhead line insulators
13. To study of sag and stress on overhead conductors

6EE08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN - LAB

Develop Minimum Eight (8) Computer programme:

List of Computer Programms:
1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.

5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EE09 COMPUTER TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following

- Computer Network: Basic Hardware and Terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of Operating systems, Application software in Personnel Computer or laptop.
- Study of PLCs usedforIndustrial automation, developing the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipment.
- Develop the simulation models for various tasks in electrical engineering using Simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.

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B.E. (ELECTRICAL & ELECTRONICS ENGG.) SEMESTER - V

5EX01/4EP03 CONTROL SYSTEMS

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling ofthe Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I : Introduction to automatic control: Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components: Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis: Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability: Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods: Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response: Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

BOOKS RECOMMENDED:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai &Co.

5EX02/ 5 EP02 MICROPROCESSORS & MICROCONTROLLER

Course Outcomes:
After completing the course the students will be able to
1. Recite Fundamentals and Architecture of Microprocessor 8085
2. Interpret Assembly Language Programming of Microprocessor 8085
3. Illustrate interfacing of programmable devices with Microprocessor 8085
4. Apply knowledge of Microprocessor 8085 for measurement of Electrical quantities
5. Discuss Fundamentals and Architecture of Microprocessor 8086
6. Explain Fundamentals and Architecture of Microcontroller 8051

Unit I: 8085-architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings

Unit II: Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085 (software and hardware interrupts), Data transfer schemes, serial data transfer through SOD and SID line.

Unit III: Programmable Interfacing devices: internal architecture and programming of PPI (8255), PIC (8259), and USART (8251). PIT (8253)

Unit IV: 8085 Microprocessors applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of pulse width using parallel port, SID lines, interrupts and timer and counter. Magnitude measurement techniques: rectification, sampling etc. measurement of fundamental quantities (voltage, current, frequency, speed) and derived quantities (resistance, inductance, capacitance, phase angle, power factor).

Unit V: Microprocessor 8086 General Idea of Architectural Advancements of Microprocessors: Pipelining, Cache memory, Memory Management, Virtual Memory System Features of 8086 Microprocessor
Register Organization of 8086: General Data Registers Segment Registers Pointer and Index Registers Flag Register Internal Organization of 8086 Bus Interface Unit (BUI) Execution Unit (EU) Memory Segmentation Flag register and description of all flag bits Interrupts

Unit VI: Introduction to microcontroller: 8051 architecture , 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory, study of instruction set of 8051.

Text Book: Microprocessor Architecture, Programming, and Applications with the 8085, Romesh Gaonkar PHI Publication - 2006

Reference Books:
1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkely California, 1980
2. Introduction to Microprocessor L. Gibson, Prentice-Hall, 2003
3. Advance Microprocessor and Peripherals, K. M. Bhurchandi & A. K. Ray, 2nd Edition, Tata McGraw Hill, 2006.
4. Microprocessor 8086 ,Sunil Mathur PHI 2010
5. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2000
6. The 8051 Microcontroller and Embedded Systems: Using Assembly and C,M A Mazidi,J.GMazidi and Mckinlay, 2nd Edition, Pearson.

5EX03/5EP03 ELECTRICAL MACHINES – II

Course Outcomes:

After completing this course students will be able to
1. Describe the construction, working operation & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single-phaseInduction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor – I:
Construction,Types (squirrel cage and slip-ring), Rotating Magnetic Fields, principles of operation, Working, Torque Slip Characteristics, Starting and Maximum Torque. Effect of parameter variation on torque slip characteristics (variation of rotor and stator resistances, stator voltage, frequency).Equivalent circuit. Phasor Diagram, Performance evaluation by direct & indirect testing, circle diagram.

Unit II: Three phase induction motor – II:
Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Generator operation Self-excitation, Doubly-Fed Induction Machines.

Unit III: Single phase Induction Motor:
Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator:
Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model and phasor diagram, methods of determining the regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor:
Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve & power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors :
Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari &I.J. Nagrath, ñElectrical Machinesò- 5thEdition, TMH Publication.
2. S. Langsdorf, ñAlternating current machinesò, McGraw Hill Publication.

Reference Books:

1. Stephen D. Umans, ñFitzgerald and Kingsleyôs Electric Machineryò, 7th Edition, McGraw Hill Publication, 2020.
2. M. G. Say, ñPerformance and design of AC machinesò, CBS Publishers, 2002.
3. P. S. Bimbhra, ñElectrical Machineryò, Khanna Publishers, 2011.
4. C L Dawes, ñA Course in Electrical Engineering (Volume -2)ò, McGraw Hill Publication

5EX04/ 5EP04 Professional Elective-I
1. Power System Operation And Control

Course Outcomes:
After completing this course students will be able to:

1. To impart knowledge to describe, calculate and analyze energy generation, unit commitment problem in thermal power plant, power system behavior and economics of generating costs.
2. To understand and analyze optimal dispatch with transmission losses, penalty factor and automatic load dispatch.
3. To learn s:the concept of real and reactive power flow and its control in power system.
4. To learn the automatic voltage regulator and automatic load frequency control.
5. To learn tie line interchange between interconnected utilities.
6. To illustrate various ways of interchange of power between interconnected utilities.
7. To impart knowledge about various advanced controllers such as FACTs controllers with itsevolution, principle of operation, circuit diagram and applications.

Unit I : **Economic Operation – Part I :**
Meaning of optimum scheduling, UCP and LSP; Input ï Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs; Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Unit II : **Economic Operation – Part II:**
Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

Unit III : **A. Generator Control Loops :**
Concept of real and reactive power; Effect of real and reactive power on system parameters; Basic generator control loops.

B. Automatic Voltage Regulator (AVR) :
Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Unit IV : **Automatic Load Frequency Control:**
Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

Unit V : **Control Area:**
Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system ï Dynamic response; Tie-line bias control.

Unit VI : **Energy Control of Power System :**
Interchange of power between interconnected utilities, economy interchange evaluation, interchange evaluation with unit commitment, typ:es of interchange, capacity and diversity interchange, energy banking, emergency power interchange, inadvertent power exchange, power pools, Circuit diagram and applications of FACTs Technology :- SVC, TCSC, STATCOM and UPFC.

Text Books :-
1. O. L. Elgerd ñElectric Energy Systems Theory: An Introductionò 2nd edition, McGraw-Hill Book Comp. N. Y. 1987.
2. Power System Operation & Control, N.V.Ramana, PEARSON education, 2010.
3. Power System Operation by R.Miller, J.H.Malinowski, TMH, 2nd reprint 2009

Reference Books :
1. L. K. Kirchamayor ï Economic Operation of Power System- Wiley Estern Pvt. Ltd., New Delhi.
2. Hadi Saadat ï Power System Analysis ï WCB/McGraw-Hill International Edition 1999
3. I.J. Nagrath, D. P. Kothari ï Modern Power System Analysis ï Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi
4. P. S. R. Murty ï Power System Operation and Control ï Tata Mc-Graw Hill Publishing Company, New Delhi.
5. Wood and Wollenberg ï Power Generation, Operation and Control ï Willey ï Inter Science Publication

5EX04 PROFESSIONAL ELECTIVE – I : ELECTRICAL ENGINEERING MATERIALS

Course Outcomes:
After completing this course students will be able to
1. understand importance of electrical engineering materials
2. understand how electric conduction takes place in conductors
3. understand importance of semiconductors and magnetic materials in electrical engineering.
4. understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials:
Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials. Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials: Review of metallic conduction on the basis of free electron theory. Variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder.
Unit-III Semiconductors: Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials: Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays.
Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.

Unit-V: Di-electrics & Insulating Materials: Dielectrics, Factors influencing dielectric strength. Capacitor rmaterials. Insulating materials, Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-VI: Materials for Special Applications: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text & Reference Books:
1. Electrical Engineering Materials by Dekker A.J (PHI)
2. Electrical Engineering Materials by S.P.Seth (Dhanpatrai and Sons)
3. An Introduction to Electrical Engineering Materials by Dr. C. S Indulkar & Dr. S. Thiruvelgadam (S. Chand Pub.)

5EX04 PROFESSIONAL ELECTIVE – I : ANALOG COMMUNICATION SYSTEMS

Course Outcomes:
After study through lectures and assignments, students will be able to:

1. To evaluate the performance of analogue communications in the presence of noise.
2. To analyze various methods of baseband/band pass Analogue transmission and detection.
3. Analyze and allocate performance of AM, FM transmitter and receiver systems.
4. Gain the knowledge of components of analogue communication system

Unit I : Signal and Noise : - Audio signals, frequency range speech and music, sound intensity, loudness, level, frequency response, bandwidth, bandwidth requirement for different types of signals such as telegraph, telephone speech, music and video Noise: External and internal noise, noise figure, signal to noise ratio, noise figure measurement.

Unit II: Modulation Techniques : - Amplitude modulation theory, Frequency spectrum representation of AM, Modulation index side bands, power relations, current relations and voltage relation in the AM wave. Frequency modulation and phase modulation, frequency deviation, modulation index, frequency spectrum.

Unit III: AM Transmitters: - Principles of DSB-FC, DSB-SC, SSB-SC modulation and their comparison, Details of DSB-FC transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC transmitter. Generation of SSB-SC by phase-shift method.

Unit IV : AM Receivers : - TRF receiver, superhetrodyne receiver, details of each block such as RF amplifier, Oscillator, IF amplifier, Diode detector, audio amplifier. Mixer: Principle, Need and type of AGC, Practical radio receiver circuit with AGC, characteristics such as selectivity, sensitivity, and fidelity communication receiver.

Unit V : FM Transmitter : - Circuits for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow band and wide band FM, their comparison, de-emphasis and pre-emphasis. FM transmitter & stereo FM transmitter.

Unit VI : FM Receivers :- Details of FM receiver, blocks such as RF amplifier, local oscillator, IF amplifier, Mixer, audio Ampl. AGC, limiter, FM discriminator, single slope and balanced slope detector, analysis of Foster seeley and ratio detectors, stereo FM receiver.

Text Book: Kennedy G.: Electronics Communication System, Tata McGraw Hill Co. New Delhi.

Reference Books :-

1. Young P.H.: Electronics Communication Techniques, A Bell and Howell Co. Indiana.
2. Martin James. : Telecommunication and the Computer, Prentice Hall Inc. New Jersey.
3. Roddey D. Coolen S.: Electronics Communication, Prentice Hall India Pvt. Ltd.
4. Beck, Robert and J.Schoen: Electronics Communication, Modulation and Transmission, A. Bell and Howell Co.

5EX06/ 5FEEP05 Open Elective – I
1. ELECTRICAL DRIVES

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Applications
3. Demonstrate various starting, braking and speed control methods of D.C. Motors
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor& special motors

Unit I: Concept of electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Types of duties: continuous, intermittent and short time. Selection of an electric drive for particular applications.

Unit II: Theory, principle, Characteristics of Power Transistor, SCR, Power MOSFET and IGBT. Introduction to single phase & three phase fully controlled bridge convertors.

Unit III: D.C. Motors: Types, characteristics, Torque equation, Starting and braking, Speed control and Applications.

Unit IV: Three phase Induction Motors: Types, construction, principle of working, characteristics and applications. Starting and braking. Speed control methods: Thyristorized stator voltage control of three phase induction motor.

Unit V: Single phase Induction Motors: Double revolving field theory, Cross field theory, types, construction, principle of working, starting methods and applications.

Unit VI: Special Motors: Construction, Principle of working, and applications of D.C. servo motors, stepper motors, Brushless D.C. motors and Universal motor.

Text Books :

1. S.K.Pillai : A First Course on Electrical Drives by New Age International Publishing Co. Ltd.
2. I.J.Nagrath & D.P.Kothari : Electric Machines by Tata Mc Graw Hill Publishing Co. Ltd.

Reference Books :

1. Vedam Subrahmanyam: Electric Drives : Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.
2. Ion Boldea, Nasar. S A : Electric Drives by CRC Press India
3. Ashfaq Husain: Electric Machines by Dhanpat Rai & Co. Ltd
4. M.D.Singh & K.B.Khanchandani : Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
5. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd ,New Delhi

5 EX06/ 5FEEP05 Open Elective – I
2. POWER PLANT ENGINEERING

Course Outcomes: -
1) Describe different Sources of Energy Generation
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction: Energy resources and their availability, types of power plants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro Electric Power Plant: Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection, advantages & disadvantages

Unit-III: Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant , Site selection, coal storage, coal handling systems, ash handling systems, working of various parts: Economizer, air preheater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages.

Unit-IV: Nuclear Power Plants: Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant: Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closed cycle gas power plant, combined gas and steam cycle.

Unit-VI: Power Plant Economics: Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives of Tariff, Types of Tariff.

Text Books:
1. Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications

Reference Books:
1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Principles of Power System by V.K.Mehta, S.Chand publication.
3. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.
4. Power Plant Engineering, P. K. Nag

5EX06 CONTROL SYSTEM - LAB

Student should perform minimum eight practicals based on syllabus.
Minimum eight experiments based on the syllabus content of 5 EX06 Control Systems. The intensive list of experiment is given below:

1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination of Frequency Response of Given R-C Network
7. Determination of Transfer Function of A.C. Tacho-Generator
8. Experimental Study of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

5EX07 MICROPROCESSOR & MICROCONTROLLER - LAB

Student should perform minimum eight practicals based on the syllabus .

List of Experiments:
1. Write anAssembly Language Program for the Addition of two 8-bitnubers and 16-bit numbers
2. Write an Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8-bit numbers
4. Write a Program for Finding the largest and smallest number from an array of ten, 8-bit numbers
5. Write a Program for Masking and setting of nibbles

6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085 Microprocessor using 8255 PPI
12. Write a Program for Interfacing DAC with 8085 Microprocessor using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC voltage and Current using ADC and 8255 PPI
15. Study of Architectural Difference Between Microprocessor 8085,8086 and Microcontroller 8051.

5EX08 ELECTRICAL MACHINES-II- LAB

Student should perform minimum eight practicals based on the syllabus.

List of Experiments:

1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three-phase alternator with infinite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MMF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V & inverted V curves of synchronous motor.

5EX09 INFORMATION &COMMUNICATION TECHNOLOGY- LAB

Student needs to complete minimum eight assignments based on the following:

Word Processing with MS-Word:

- Basic operations- Editing and Formatting text, paragraphs and pages, Printing the documents.
- Working with tables, figures, images.
- Mail merge. Working with Charts, Equations, Symbols.

Working with workbooks /work sheets.

- Data Entry techniques & Defining data set as a Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting/ Filtering data in excel sheet.

Working with MS Power Point.

- Presentation Basics. Adding more components to the slides, Printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using Slide Master.
- Working with Graphics, Images and Clips.
- Working with Multimedia. Inserting Sound and Narration.
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving/Protecting the Presentation.

Working with Latex:

- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figure & images.

Web Page Development

- Introduction to HTML, CSS, JAVA Coding.
- Development of Web page.

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B.E. (ELECTRICAL & ELECTRONICS ENGG.) SEMESTER - VI

6EX01 POWER ELECTRONICS

Course Outcomes:

After completing this course student will be able to:

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various single phase and three phase power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC and AC/AC converter circuits
6. Demonstrate the applications of power electronic circuits.

Unit I: SCR, Triac, Diac ï Construction and Applications, two Transistor Analogy of SCR, SCR turn ON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs ,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage and over-current protection, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

Unit III: Principle of phase control, half wavecontrolled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.
Three phase half controlled bridge and fully controlled bridge rectifier.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode,single phase transistorized bridge inverter.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Basic principle of cycloconverter, single phase to single phase cycloconverter, Introduction, principle of operation of single-phase voltage controllers for R and R-L load.
Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Book: Rashid Muhammad, H., ñPower Electronics: Circuits, Devices and Applicationsò, 2nd Edition. Prentice-Hall, 1998.

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., ñPower Electronics: Converter, Applications and Designò, John Wiley & Sons, 1994.
2. M.D. Singh & K.B. Khanchandani, ñPower Electronics ñTata Mc-Graw Hill, New Delhi
3. Dewan, S.B. and Satrughan A., ñPower Semiconductor Circuitsò, John Wiley & Sons,
4. Dubey, G.K., Doradlla, S.R., ñThyristerised Power Controllersò, Wiley Eastern, 1987.

6EX02 POWER SYSTEMS -II

Course Outcomes:

At the end of the course, students will be able to:

1. Able to understand Power Factor improvement, Capacitor bank installation in distribution system, metering system in Industries and Residential area.
2. Able to understand Positive Sequence, Negative & zero sequence system and fault analysis.
3. Create computational models for analysis of both symmetrical and unsymmetrical conditions in power systems,
4. Analyze the system performance where there is an unbalanced fault, and also calculate the corresponding fault current.
5. To examine the need of various analysis like fault analysis, short circuit analysis stability analysis, steady state and transient analysis.

SECTION- A

Unit I : Symmetrical components:
Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements ï sequence impedance and sequence networks ; Various three phase transformer connections ï zero sequence rules; Unbalanced load system - application.

Unit II : Symmetrical Fault Analysis:
Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

Unit III : Unsymmetrical Fault Analysis: L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults- loaded and unloaded conditions.

SECTION-B

Unit IV : Over voltages: Causes ï internal and external; Voltage surge, Basic insulation level, Protection ï earthing screen, overhead ground wire, lightning arresters.

Unit V : HVDC Transmission Basic principle: Transmission equipments, Comparison with AC links, Inverters ï reactive power requirement; Converters, DC links, Circuit breaking, ground return, Economic distance, modern developments.

Unit VI : Corona Effect : Power loss due to corona , Practical importance of corona, use of bundled conductors in E.H.V transmission lines and its advantages, Overhead line insulators ,Voltage distribution in suspension type insulator, String efficiency , Grading . Sag and stress calculation of overhead conductance, Vibration dampers .

Text Book:- Power System Analysis, N.V.Ramana, PEARSON education, 2010.

Reference Books:
1. Power System Analysis, Arthur R. Bergen, Vijay Vittal, 2nd Edition, 2009, PEARSON Education
2. I. J. Nagrath & D. P. Kothari ï ñModern Power System Analysisò, Tata- Mc-Graw Hill Publishing Company, New Delhi.
3. Electrical Power System, DEPAPRIYA DAS (D. DAS)

6EX03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcomes:
After completing this course, student will be able to
1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Unit I: Introduction:
Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD, Introduction to FEM based machine design.

Unit II: Transformer Design –I:
Transformer Core Design - material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, minimum losses, Minimum weight & Minimum volume.

Unit III: Transformer Design – II:
Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces ï types &causes.Estimation of efficiency & regulation from design data. Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC winding Design:
Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction motor stator design:
Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot-numbers, shape and dimensions, stator teeth dimension, stator core dimensions. Air gap length calculation.

Unit VI: Induction motor rotor design:
Squirrel cage rotor design ï selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design -** rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:
1. A. K. Sawhney, ñA Course in Electrical Machine Designò Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, ñPrinciples of Electrical Machine Designò, S.K.Kataria and Sons, Delhi.

Reference Books:
1. M.G.Say,ñThe Performance and Design of Alternating Current Machinesò, C.B.S. Pub., Delhi.
2. K.G.Upadhyay,ñDesign of Electrical Machinesò, New Age international Publishers, 1st Edition 2008
3. S.K.Sen,ñPrinciples of Electrical Machine Design with Computer Programsò, Oxford and I.B.H. Company Pvt. Ltd., New Delhi.
4. Indrajit Dasgupta, ñDesign of Transformersò, TMH 1st Edition 2002
5. Indian Standards for Transformer & Three phase IM design from BIS websites

6EX04 Professional Elective - II
1. ADVANCED CONTROL SYSTEM

Course Outcomes:
After completing this course students will be able to
1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.
6. Analyze the Nonlinear system using Phase plane Analysis.

Unit I: Compensation Techniques:
Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead - Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I:
State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition ï Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response ï SISO systems.

Unit III: State Space Technique II:
Concept-controllability and observability , SISO/ MIMO linear Systems Gilbertôs method and Kalmanôs test; SISO controllable Systems design ï state feedback.

Unit IV: Sampled Data Control Systems:
Representation,Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Juryôs test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I: Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: **Non-Linear System Analysis II**: Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction ï analytical and graphical method by isoclines, stability analysis, limit cycles, limitations ï phase plane method.

Text Books:
1. Nagrath and Gopal, òControl system Engineeringò Wiley Eastern Ltd , New Delhi
2. K.Ogata,ò Modern Control Theory ñPrentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:
1. Naresh Sinha. ñControl system Engineeringò Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. ñAutomatic Control systemò Prentice Hall Of India Pvt Ltd Delhi
3. D Roy Choudhury, ñModern Control EngineeringòPublisher: PHI Learning

6EX04 Professional Elective – II:
2. Digital Communication systems

Course Outcomes:
After Completing this course student will be able to:
1. To study basic building blocks of digital communication system.
2. To learn information theory and theoretical bounds on the data rates of digital communication.
3. To understand and analyze communication channel.
4. To study and analyze different digital modulation techniques.
5. To study baseband transmission of the signal.
6. To understand importance of channel encoding and decoding in digital communication.
7. To study multiple access schemes and spread spectrum communication

Unit-1 Introduction to Digital Communication Sstem:
Functional Blocks of Digital Communication System; Source Encoder and Decoder, Channel Encoder and Decoder, Modulator and Demodulator. Line Coding: Need for Line coding, Properties of Line Coding, Unipolar RZ and NRZ, Polar RZ and NRZ, Bipolar NRZ (AMI), Split Phase Manchester Coding, Polar Quaternary NRZ Coding, HDB3 Coding, Scrambler and Unscrambler.
Unit-2 Information Theory: Measure of Information, Entropy and Information Rate of Long Independent and Dependent Sequences. Source Encoding: Huffman Encoding, Shannonôs Encoding Algorithm, Shannon- Fano Algorithm. Discrete Communication Channel: Noiseless Channel, Deterministic Channel, Binary Symmetric Channel, Rate of Information Transfer over Discrete Channel, Capacity of Discrete Memoryless Channel.Continuous Channel: Shannon Hartley Theorem for channel capacity, Signal to Noise Ratio ï Bandwidth Tradeoff.
Unit-3 Bandpass Modulation and Demodulation techniques:
BPSK, BFSK, ASK and DPSK generation and reception, Signal space diagram, PSD and Bandwidth of BPSK and BFSK systems, QPSK. Transmitter and Receiver, Signal space diagram, PSD and Bandwidth of QPSK, Probability of Error of ASK, BPSK and BFSK systems, Comparison of Digital modulation systems. Coherent Detection: Matched Filter (Impulse response and Probability of Error).
Unit-4 Base Band Transmission: Base Band Binary PAM systems, Inter Symbol Interference, Base Band Pulse Shaping and Nyquist Criterion, Eye Diagram, Correlative Coding: Duobinary Encoder with Pre-coder, Modified Duobinary Encoder, Modified Duobinary Encoder with Pre-coder. Equaliation: Need for equalization, Transversal Equalizer (Problems Expected), Preset Equalizer, Adaptive Equalizer, Clock and Carrier Synchronization.
Unit 5: Error Control Coding: Introduction to Error Control Coding, Types of Errors, Methods of Controlling Errors, Linear Bloc Codes:Matrix Description of Linear Block codes, Hamming Distance, Hamming Weight, Minimum Hamming Distance, Hamming Codes, Encoder for Linear Block code, Syndrome Decoding, Syndrome Decoder for (n, k) Linear Block Code, Error Detection and Correction capability of Linear Block Codes (Derivation expected). Cclic Codes:Properties of Cyclic Codes, Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes, Encoders for Cyclic Codes, Syndrome Decoding for Cyclic Codes. Convolution Codes: Time Domain Approach and Transform domain approach for convolution code generation, Code Tree and Code Trellis for Convolution code.

Unit 6 : Multiple Access Schemes and Spread Spectrum Communication: Multiple Access schemes: Time Division Multiple Access, Frequency Division Multiple Access, Code Division Multiple Access, Space Division Multiple Access.Spread Spectrum Sstems: Notion of Spread Spectrum, PN Sequence Generation (Problems Expected), Direct Sequence Spread Spectrum (DSSS), Jamming Margin, Processing Gain, Eb/No Ratio, Frequency Hopped Spread Spectrum, Slow and Fast frequency Hopping

Text Books :

1. Shanmugam K.S. ñDigital & Analog Communication Systemsò, John Wiley & Sons, New York, 1996.
2. Lathi B. P., ñModern Digital and Communication Systemsò, Holt Rinchart and Winston Inc., New York, 1993.
3. Simon Haykin, ñDigital Communicationò, John Wiley and Sons,Pvt. Ltd., Singapore.

References:

1. Proakis J. K., ñDigital Communicationò, Mc-Graw Hill Book Co., London (Second Edition)
2. Taub, Herbert, Schilling D.L., ñPrinciples of Communication Systemsò, Mc-Graw Hill International Book Co., Tokyo.
3. W.C.Y. Lee, ñMobile Cellular Telecommunications Systemsò, Mc-Graw Hill International Editions, 1990.
4. Glover and Grant, ñDigital Communicationò, Prentice Hall Publication.

6EX04 Professional Elective – II
3. INDUSTRIAL ELECTRICAL SYSTEM

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. Representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components:

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

Unit II: Residential and Commercial Electrical Systems:

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III: Illumination Systems :

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit IV: Industrial Electrical Systems – I:

HT connection, industrial substation, Transformer selection, Industrial loads, motors, startingof motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction ï kVAR calculations, type of compensation, Introduction to PCC,MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit V: Industrial Electrical Systems – II:

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit VI: Industrial Electrical System Automation :

Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Book: S. L. Uppal and G. C. Garg, ñElectrical Wiring, Estimating & Costingò, Khanna Publishers, 2008.

Reference Books:

1. K. B. Raina, ñElectrical Design, Estimating & Costingò, New age International, 2007.
2. S. Singh and R. D. Singh, ñElectrical estimating and costingò, Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, ñResidential Commercial and Industrial Systemsò, McGraw Hill Education, 2008.

6EX05 Open Elective – II
1. ENERGY AUDIT AND MANAGEMENT

Course Outcomes:

After completing this course student will be able to:

1. Discuss energy scenario and its management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discuss various energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Unit I : Energy Scenario & Management:
Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:
Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energyð production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:
Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:
Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:
Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:
Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions-active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:
1. S. C. Tripathy, ñUtilization of Electrical Energy and Conservationò, McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press.
4. Energy Audit and Conservation TERI.

6EX05/ Open Elective – II
2. ELECTRICAL ESTIMATING & COSTING

Course Outcomes:
After completion of the course students will be able to:
1. Understand methods of installation and estimation of service connection
2. Decide type of wiring its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation:
Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation. Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection.Estimation of service connection.

Unit II : Residential Building Electrification :

Procedures for designing the circuits and deciding the number of circuits. Selection of type of wiring and rating of wires & cables. Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of commercial Installation:

Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:

Concept of Industrial load. concept of Motor wiring circuit. Important guidelines about power wiring and Motor wiring. Selection and rating of wire, cable size. Sequence to be followed to prepare estimate. Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:
Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution:
Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technicalsanctions.Billing of executed work.

Text Book: Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.

Reference Books:
1. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi
2. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6EX06 POWER ELECTRONICS - LAB

List of Experiments:
1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EX07 POWER SYSTEMS - II LAB

List of Experiments:
1. Determination of negative sequence reactance of a synchronous generator
2. Determination of zero sequence reactance of a synchronous generator
3. To study various types of current limiting reactors
4. To study the mechanism of lightning arrester
5. Introduction to use of Simulation package (Power World Simulator) for power systems
6. To study substation layout and its components
7. To study HVDC Transmission System
8. To simulate three phase fault for a given power system using MATLAB Simulink
9. To find the direct axis synchronous reactance, X_d& quadrature axis synchronous reactance, X_q of a salient pole synchronous machine by slip test
10. To find the direct axis subtransient reactance, X_dò & quadrature axis sub ïtransient reactance, X_qò of a salient pole synchronous machine by conducting static test
11. TO study of corona on EHV lines.
12. To study of faults at overhead line insulators
13. To study of sag and stress on overhead conductors

6EX08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN - LAB.

Develop Minimum Eight Computer Programmes:

List of Computer Programmes:
1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.
5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EX09 COMPUTER TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following:

- Computer Network: Basic hardware and terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of operating systems, application software in Personnel Computer or laptop.
- Develop the simulation models for various tasks in electrical engineering using simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.
- Study of PLCs used for Industrial automation & develop the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

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SYLLABUS BE SEM. V ELECTRICAL ENGG. (ELECTRONICS & POWER)

5EP01 POWER SYSTEM- I

Course Outcomes:

After completing this course, the students will be able to:

1. Determine the parameters of transmission lines.
2. Evaluate the performance of transmission line
3. Describe transmission lines voltage control and power factor improvement methods.
4. Explain representation of power system, Ferranti effect and corona phenomenon.
5. Demonstrate various Insulators , its string efficiency & underground cables.

Syllabus:

Unit I: Transmission line parameters: calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on inductance and capacitance, interference with communication lines.

Unit II: Electrical characteristics of transmission line: V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal T and equivalent ´ representations.

Unit III: Voltage control and power factor improvement: methods of voltage control and power factor improvement, use of static VAR generators and synchronous condenser, automatic voltage control. Receiving end and Sending end power circle diagrams.

Unit IV: Representation of power systems: single line diagrams, per unit system and one-line impedance and reactance diagrams. Ferranti effect, corona phenomenon, Introduction to Travelling waves.

Unit V: Insulators: materials used, types, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Introduction to insulator testing, line supports for LV, HV, EHV and UHV.

Unit VI: Underground cables: material used for conductor & insulation, different types of cables and their construction, parameters of underground cable, grading of cable, losses, break down and rating, selection of cables.

Text Books:

1. Modern Power System Analysis by D. P. Kothari, I. J. Nagrath TMH Publishing

2. Elements of power system analysis by William D. Stevenson, Jr, McGraw-Hill International edition

Reference Books:

1. Power System Engineering by D. P. Kothari, I. J. Nagrath TMH company ltd., New Delhi
2. Narain G. Hingorani and Lazlo Gyugyi ñUnderstanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Principles of power system by V. K. Mehta, S. Chand & company ltd., New Delhi.
4. Electrical Power Systems by C. L. Wadhwa, New Age International Publishers, New Delhi
5. Electrical Power Systems by Ashfaq Husain, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
6. Electrical Power system design by M. V. Deshpande, TATA McGraw-Hill Publishing Company Limited, New Delhi.

5 EP02 MICROPROCESSORS & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to

1. Recite Fundamentals and Architecture of Microprocessor 8085, Microcontroller 8051
2. Interpret Assembly Language Programming of Microprocessor 8085, Microcontroller 8051
3. Illustrate interfacing with Microprocessor 8085, Microcontroller 8051
4. Apply knowledge of Microprocessor 8085 for measurement of Electrical quantities
5. Discusss Fundamentals and Architecture of Microprocessor 8086
6. Explain Fundamentals and Architecture of Microprocessor 8051

Unit I: 8085-architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings.

Unit II: Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085 (software and hardware interrupts), Data transfer schemes, serial data transfer through SOD and SID line.

Unit III: Programmable Interfacing devices: Internal architecture, programming and interfacing of Programmable Peripheral Interface PPI (8255), Programmable Interrupt Controller PIC (8259), and Universal Synchronous Asynchronous Receiver Transmitter USART (8251) and Programmable Interval Timer PIT (8253)

Unit IV: Introduction to microcontroller: 8051 pin configuration and architecture, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.

Unit V: Instruction set of 8051.Addressing modes. Various groups of instructions: data transfer. Arithmetic-logical group. Interrupt, timer counter related instructions. Interfacing of 8051with external memories. Programming 8051 with interfacing examples.

Unit VI: 8085 Microprocessors / 8051 Microcontroller Applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of Pulse width and Magnitude using 8085. Measurement of fundamental quantities -voltage, current, frequency, speed using 8051 Microcontroller.

Text Book: Microprocessor Architecture, Programming, and Applications with the 8085, Romesh Gaonkar PHI Publication - 2006

Reference Books:

1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkely California, 1980
2. Introduction to Microprocessor L. Gibson, Prentice-Hall, 2003
3. Advance Microprocessor and Peripherals, K. M. Bhurchandi & A. K. Ray, 2nd Edition, Tata McGraw Hill, 2006.
4. Microprocessor 8086 ,Sunil Mathur PHI 2010
5. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2000
6. The 8051 Microcontroller and Embedded Systems: Using Assembly and C,M A Mazidi,J.GMazidi and Mckinlay, 2nd Edition, Pearson.

5EP03 ELECTRICAL MACHINES – II

Course Outcomes:

After completing this course students will be able to

1. Describe the construction, working operation & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single-phaseInduction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor – I:
Construction, Types (squirrel cage and slip-ring), Rotating Magnetic Fields, principles of operation, Working, Torque Slip Characteristics, Starting and Maximum Torque. Effect of parameter variation on torque slip characteristics (variation of rotor and stator resistances, stator voltage, frequency).Equivalent circuit. Phasor Diagram, Performance evaluation by direct & indirect testing, circle diagram.

Unit II: Three phase induction motor – II :
Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Generator operation Self-excitation, Doubly-Fed Induction Machines.

Unit III: Single phase Induction Motor : Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator:
Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model and phasor diagram, methods of determining the regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor:
Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve & power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors:
Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari & I.J. Nagrath, ñElectrical Machinesò- 5th Edition, TMH Publication.
2. S. Langsdorf, ñAlternating Current Machinesò, McGraw Hill Publication

Reference Books:
1. Stephen D. Umans, ñFitzgerald and Kingsleyĝs Electric Machineryò, 7th Edition, McGraw Hill Publication, 2020.
2. M. G. Say, ñPerformance and design of AC machinesò, CBS Publishers, 2002.
3. P. S. Bimbhra, ñElectrical Machineryò, Khanna Publishers, 2011.
4. C L Dawes, ñA Course in Electrical Engineering (Volume -2)ò, McGraw Hill Publication.

5EP04 Professional Elective-I SIGNALS AND SYSTEMS

Course Outcomes :
After completing this course student will be able to
1. Demonstrate knowledge of continuous-time and discrete-time signals and systems.
2. Analyze the continuous-time systems using continuous Time Fourier transform.
3. Explain the concept of sampling, Sampling Theorem, aliasing and the Nyquist rate.
4. Analyze DT systems & their realization using Z-transforms.
5. Analyze the discrete time systems using DTFT and DFT

Unit I: Introduction to Signals and Systems: Classification of Signals Classification of Systems, Systems Modeling Some Ideal Signals, Energy and Power Signals Frequency Response, Discrimination of Continuous-Time Signals Topological Models, Analysis of Continuous-Time Systems Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems

Unit II: Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Ideal Low-Pass Filter Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Unit III: Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response.

Unit IV: Sampling: Representation of continuous time signals by its samples, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, sampling of discrete time signals

Unit V: Z- Transform: Z- transform, the region of convergence for the z-transform, Inverse z- transform, properties of Z transform, analysis and characterization of LTI systems using z transforms, System function algebra and block diagram representations, the unilateral z ï transform.

Unit VI: Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform. Fast Fourier Transform (FFT)

Text Books:
1. Alan Oppenheim &Alan Willsky ,"Signals and Systems" Prentice Hall India Learning Private Limited; 2nd edition
2. P. Ramesh Babu R. Ananda Natarajan "Signals and Systems." Scitech Publications

Reference Books:
1. Fred Taylor,Principles of Signals and Systems ñTata McGraw-Hill, 1998, New Delhi
2. Nagrath, Sharan, Ranjan Rakesh and Kumar Sukhbinderò Signals and Systemsò Tata McGraw-Hill, 1998, New Delhi.
3. S Haykin and B Van Veen, ñSignals and Systems ñJohn wiley & sons

5EP04 Professional Elective - I
2. NETWORK ANALYSIS AND SYNTHESIS

Course Outcomes :
After completing this course student will be able to
1. Analyze the transient response of series and parallel A.C. circuits
2. Demonstrate the properties of network functions.
3. Demonstrate the properties of positive Real Functions
4. Synthesize driving point functions of RL, RC and RLC
5. Synthesize two port network functions
6. Design passive filters to meet desired specifications

Unit I: Transient Analysis:
Transient response of RC, RL and RLC circuit to various excitation signals such as step, ramp, impulse and sinusoidal signals.Network solution with Laplace transformation, initial and final value theorem and convolution integral.

Unit II: **Network Functions:**
Network Functionsfor one port & two-port networks, poles and zeroes of network functions. Restrictions on poles and zeroes locations for driving point functions and transfer functions. Time domain behavior of electrical network from the pole- zeroes plot.

Unit III: Positive Real function: Driving point function, Brune̒s positive real function, properties of positive real function, testing of driving point function. An application of Maximum Modulus Theorem, properties of Hurwitz polynomial, computation of residue, even and odd functions

Unit IV: Synthesis of One Port Networks
Properties of LC, RC and RL driving point functions and their synthesis in canonical (Foster and Cauer) forms. Synthesis of RLC driving point functions which can be synthesized by partial fraction or continued fractions

Unit V: **Synthesis of Transfer Functions**
Properties of transfer functions, Zeros of Transmissions (ZOTs), synthesis of Y21 and Z21 with 1ohm termination. Synthesis of transfer functions using constant resistance single and double terminated lattice and bridge T networks. Synthesis of open circuit transfer function

Unit VI: Filter fundamentals
Classification of filters, Analysis of prototype filter section, Analysis of a prototype Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, M–Derived Filter, Low Pass Filter with RC and RL Circuits, High Pass Filter with RC and RL Circuits, Low Pass Filter with RLC Circuit. Introduction of Different Types of Active Filters

Text Books :

1. Van Valkenberg, ñNetwork Analysisò,, Prentice Hall of India (PHI)
2. Sudhakar and Shyammohan,“Circuits and Networks: Analysis and Synthesis ,McGraw-Hill Education

Reference Books:

1. Van Valkenburg ñIntroduction to Network Synthesisò, Prentice Hall of India (PHI)
2. Kelkar, Pandit, ñLinear Network Theoryò, Pratibha Publication.
3. Franklin Kuo, ñNetwork Analysis and Synthesisò, Wiley international.
4. A.Chakrabarti, ñCircuit Theoryò Dhanpat Rai & Co.
5. C.L Wadhwa, ñNetwork Analysis and Synthesisò New Age International Publishers, 2007.

5EP04 Professional Elective – I
3. ELECTRONIC COMMUNICATION THEORY

Course Outcomes:
After successfully completing the course, the students will be able to

1. Explain various types of signal & elements of communication system.
2. Analyze the signal using Fourier Transform
3. Apply Amplitude modulation & Frequency modulation on the communication signal
4. Compare Pulse communication & Digital communication
5. Describe microwave communication system.

Unit I: Introduction to Electronics Communication Systems:
Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & non periodic,Elements of Communication Systems, Transmitter, Receiver, Need for Modulation, bandwidth requirements, Noise, External, internal noise, noise calculation, noise figure.

Unit II: Signal Analysis:
Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.

Unit III: Amplitude Modulation:
Amplitude Modulation Theory, Generation of Amplitude Modulation, Single Side band Communication, suppression of carrier, suppression of unwanted sideband, AM receiver.

Unit IV: Frequency Modulation:
Theory of Frequency Modulation, characteristics of FM, Generation of FM, pre-emphasis, De-emphasis, wide &Narrowband FM Transmission, FM receiver.

Unit V: A. Pulse Communication:
Information Theory, Classification of pulse modulation, Sampling process, pulse amplitude modulation, PWM and PPM modulation pulse code modulation.

B. Digital Communication:
Fundamentals of data communication systems, data sets and interconnection requirements.

Unit VI: Microwave communication system
Analog microwave communication: LOS, OTH microwave system Satellite communication: Satellite orbits, frequencies, attitude, transmission path.

Text Book: Electronic Communication System by Kennedy, Davis, TMH

Reference Books:

1. Electronics Communication by K.Shoenbcle PHI, India.
2. Electronics Communication techniques, Paul Young, Willey Eastern Pub.
3. Principle of C.E TMIL Taub Schilling.
4. Electronics Communication - Robert Shrader McGraw Hill.

5FEEP05 Open Elective – I
1. ELECTRICAL DRIVES

Course Outcomes:
After completing this course, Students will be able to:
1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Applications
3. Demonstrate various starting, braking and speed control methods of D.C. Motors
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.
5. Describe the construction, working principle and applications of single phase Induction Motor& special motors.

Unit I: Concept of electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Types of duties: continuous, intermittent and short time. Selection of an electric drive for particular applications.

Unit II: Theory, principle, Characteristics of Power Transistor, SCR, Power MOSFET and IGBT. Introduction to single phase & three phase fully controlled bridge convertors.

Unit III: D.C. Motors: Types, characteristics, Torque equation, Starting and braking, Speed controland Applications.

Unit IV: Three phase Induction Motors: Types, construction, principle of working, characteristics and applications. Starting and braking. Speed control methods: Thyristorized stator voltage control of three phase induction motor.

Unit V: Single phase Induction Motors: Double revolving field theory, Cross field theory,types, construction, principle of working, starting methods and applications.

Unit VI: Special Motors: Construction, Principle of working, and applications of D.C. servo motors, stepper motors, Brushless D.C. motors and Universal motor.

Text Books :
1. S.K.Pillai : A First Course on Electrical Drives by New Age International Publishing Co. Ltd
2. I.J.Nagrath & D.P.Kothari : Electric Machines by Tata Mc Graw Hill Publishing Co Ltd.

Reference Books :
1. VedamSubrahmanyam: Electric Drives : Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.
2. Ion Boldea, Nasar. S A : Electric Drives by CRC Press India
3. Ashfaq Husain: Electric Machines by Dhanpat Rai & Co. Ltd
4. M.D.Singh &K.B.Khanchandani : Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
5. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd ,New Delhi

5FEEP05 Open Elective-I:
2. POWER SUPPLY SYSTEM

Course Outcomes:
After completing this course student will be able to
- Describe the Structure of Power system
- Explain construction and working of various generation plants
- Describe layout and working of Substations
- Compare various power distribution system
- Explain Electrical wiring required for various Installations

Unit I: Structure of Power System :
Generation, transmission and distribution. Power generating stations ï different types. Steam power stations: Main parts and working, Water tube boiler, Fire tube boiler and their characteristics. Main flow circuits of steam power station. Power station auxiliaries,

Unit II: Gas-turbine power stations:
Main parts, plant layout and Bryton cycle operation. Combined cycle generation & Cogeneration. Nuclear power stations- Layout of nuclear power station, types of power reactors, main parts and control of reactors, nuclear waste disposal, radioactivity and hazards.

Unit III: Hydro-electric stations:
Site selection, constituents and schematic arrangement of hydroelectric stations, principles of working, types of turbines, Layout and working of Pumped storage plant.

Unit IV: Substation:

Classification of substations, Major equipment, Selection & location of site for substation, Main Electrical connections, Symbols for various apparatus & circuit elements in substation, 66/11kV and 11kV/400V substation Key diagram, Busbar layouts. Auxillary supply, substation earthing.

Unit V: Power distribution system:
Primary and secondary distribution, types of conductors in Distribution system. Connection Scheme: radial, parallel, ring main, comparison of distribution systems

Unit VI: Electrical wiring and installation:
Domestic, commercial and industrial wiring, main, sub-main and sub-circuit wiring.Types and need of Earthing.Fuse and disconnecting devices. Electrical Safety precautions.

Text Books :
1] Principles of Power System, by V K Metha and RohitMetha, S Chand Publication
2] Generation of Electrical Energy, by B R Gupta, S Chand Publication

Reference Books :
1] A Course in Power System J B Gupta, S Chand Publication
2] Elements of Electrical Power Station Design, by M. V. Deshpande, Wheeler publications
3] Electrical Installation Estimating & Costing by J. B. Gupta
4] Transmission & Distribution by H. Cotton.

5FEEP05 Open Elective – I
3. POWER PLANT ENGINEERING

Course Outcomes: -

1) Describe different Sources of Energy Generation
2) Explain the Working and layout of steam power plant & hydro power plant.
3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant
4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction:
Energy resources and their availability, types of power plants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro Electric Power Plant:

Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection, advantages & disadvantages

Unit-III: Steam Power Plants:

Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant , Site selection, coal storage, coal handling systems, ash handling systems, working of various parts: Economizer, air preheater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages

Unit-IV: Nuclear Power Plants:

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant:

Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closed cycle gas power plant, Combined gas and steam cycle.

Unit-VI: Power Plant Economics:

Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives of Tariff, Types of Tariff.

Text Books:

1. Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications.

Reference Books:
1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Principles of Power System by V.K.Mehta, S.Chand publication.
3. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.
4. Power Plant Engineeirng. P. K. Nag.

5EP06 POWER SYSTEM – I LAB

Student should perform minimum eight practicals based on the syllabus

List of Experiments:

1. To study the performance of a transmission line using a nominal T model.
2. To study the performance of a transmission line using a nominal ´ model.
3. To calculate A,B,C,D parameters for a transmission line by using nominal T model
4. To calculate A,B,C,D parameters for a transmission line by using nominal ´ model.
5. To study skin effect, proximity effect and Ferranti effect in transmission line.
6. To study Corona phenomenon and corona loss and its control in transmission line.
7. To study conversion of single line diagram to impedance diagram and reactance diagram for a typical power system.
8. To draw the circle diagram for a typical power system.
9. Study of a tap changing transformer (ON load and OFF load tap changing).
10. Study of static VAR generator and synchronous condenser.
11. To study different types of insulators used in power system & their comparison.
12. To conduct a dry and wet test on a pin type insulator.
13. To conduct a flashover test on an insulator.
14. To study a horn gap.
15. To study different types of power cables.
16. To study testing of cables.
17. To draw different Tower structures

Note: Above experiments may be conducted by using models, simulation, numerical, drawing sheets or experimentation.

5EP07 MICROPROCESSOR & MICROCONTROLLER- LAB

List of Experiments:
Student should perform minimum eight practicals based on the syllabus

1. Write an Assembly Language Program for the Addition of two 8-bit/16-bit numbers
2. Writean Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8- bit numbers
4. Write a Program for Finding the largest/smallest number in array of 8-bit numbers
5. Write a Program for Masking and setting of nibbles
6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085/8051using 8255 PPI
12. Write a Program for Interfacing DAC with 8085/8051 using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC Voltage /Current using ADC, 8255 PPI
15. Study of Architectural Differences: Microprocessor 8085, and Mcrocontroller 8051

5EP08 ELECTRICAL MACHINES-II LAB

Student should perform minimum eight practicals based on the syllabus**.**

List of Experiments:

1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM
6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three-phase alternator with infinite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MMF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V & inverted V curves of synchronous motor.

5EP09 INFORMATION & COMMUNICATION TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following:

Word Processing with MS-Word:
- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figures, images.
- Mail merge. Working with Charts, Equations, symbols.

Working with workbooks /work sheets.
- Data Entry techniques & Defining data set as a Table.
- Setting, Previewing, and Printing under MS-Excel.
- Performing Calculations, using Excel Formulas, Functions and Charts.
- Sorting/ Filtering data in excel sheet.

Working with MS Power Point.
- Presentation Basics. Adding more components to the slides, Printing the slides.
- Formatting Presentations, backgrounds and layout. Applying Themes. Using Slide Master.
- Working with Graphics, Images and Clips.
- Working with Multimedia. Inserting Sound and Narration.
- Delivering Presentations. Animating Objects. Adding Action effects.
- Live Presentation. Using Custom Shows.
- Saving/Protecting the Presentation.

Working with Latex:
- Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
- Working with tables, figure & images.

Web Page Development:
- Introduction to HTML, CSS, JAVA Coding.
- Development of Web page.

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6EP01 POWER ELECTRONICS

Course Outcomes:

After completing this course student will be able to
1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various single phase and three phase power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC and AC/AC converter circuits
6. Demonstrate the applications of power electronic circuits.

Unit I: SCR, Triac, Diac ï Construction and Applications, two Transistor Analogy of SCR, SCR turn ON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction to Power MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs ,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage and over-current protection, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

Unit III: Principle of phase control, half wavecontrolled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance.

Three phase half controlled bridge and fully controlled bridge rectifier.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 120^0 and 180^0mode,single phase transistorized bridge inverter.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Basic principle of cycloconverter, single phase to single phase cycloconverter, Introduction, principle of operation of single-phase voltage controllers for R and R-L load

Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier. Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Books:

1. M.D. Singh & K.B. Khanchandani, ñPower Electronics ñTata Mc-Graw Hill, New Delhi
2. Rashid Muhammad, H., ñPower Electronics: Circuits, Devices and Applicationsò, 2nd Edition. Prentice-Hall, 1998

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., ñPower Electronics: Converter, Applications and Designò, John Wiley & Sons, 1994.
2. LandevCyrill, W., ñPower Electronicsò, McGraw Hills, London, 1981.
3. Dewan, S.B. and Satrughan A., ñPower Semiconductor Circuitsò, John Wiley & Sons,
4. Dubey, G.K., Doradlla, S.R., ñThyristerised Power Controllersò, Wiley Eastern, 1987.

6EP02 ELECTRICAL ENERGY DISTRIBUTION & UTILISATION

Course Outcomes:
After completing this course, Students will be able to:
1. Demonstrate the knowledge of distribution substation
2. Compare different power distribution systems
3. Describe elements of distribution Automation system
4. Select proper electrical drive for industrial applications
5. Explain the workingof electric traction system
6. Describe an illumination system & electric heating

Unit I: Substation: Selection & location of site, classification, major equipment ,graphical symbols for various apparatus & circuit elements ,key diagram for 33/11kV substation along with selection & specification of substation equipment, types of bus-bar arrangements, substation earthing. Introduction to Gas Insulated Substation (GIS).

Unit II: Power distribution system -I: Primary and secondary distribution, types of conductors in Distribution system, comparison of distribution systems radial, parallel and ring main, economics of feeder design.

Unit III: Power distribution system - II: Methods for reduction of line losses in distribution system. Introduction to High Voltage Distribution System (HVDS). Distribution Automation: Need for distribution automation, feeder automation, and communication requirements for Distribution automation, Remote terminal unit (RTU). Introduction to SCADA systems.

Unit IV: Electrical Drives: Concept, types, selection criterion for electrical drive. Types of duties, rating calculations for these duties. Heating and cooling. Industrial applications: Textile mill, Cement mill, Sugar mill.

Unit V: Traction System: Requirement, speed- time curves. General features, types, Quadrantal diagram of speed-torque characteristics of traction motors. Control of traction motors: Series-Parallel control. Different accessories for track electrification ï overhead wires, conductor rail system, current collector-pantograph

Unit VI: Illumination : Street lighting**:** Principle, illumination level, mounting height of lamps, spacing, types of lamps. Flood lighting: Flood lighting calculations, waste light factor, Depreciation factor, Utilization factor. LED: Working principle, advantages & applications.
b) **Electric Heating**:Resistance& Induction heating & its applications.

Text Books:
1. S.K.Pillai, ñA First Course on Electrical Drivesò, New Age International Publication
2. J.B.Gupta, ñA Course in Power Systemò, S.Chand Publication

Reference Books:
1. M.V.Deshpande, ñElectrical Power System Designò, TMH Publishing Company Ltd
2. S.Sivanagaraju&S.Satyanarayana, ñElectric Power Transmission & Distributionò Pearson Publication
3. P. S. Satnam&P.V.Gupta, ñSubstation design & Equipmentò Dhanpat Rai Publication.
4. J.Upadhyay&S.N.Mahendra : Electric Traction by Allied Publishers Ltd
5. J.B.Gupta :Utilization of Electric Power & Electric Traction by S.K.Kataria& Sons, New Delhi.
6. H.Pratap :Art & Science of Utilization of Electrical Energy by Dhanpat Rai & Company Ltd.
7. H Pratap, ñModern Electric Tractionò Dhanpat Rai & Sons Ltd
8. Dr.M.K.Khedkar&Dr.G.M.Dhole : A Textbook of Electrical Power Distribution Automation by University Science Press
9. S.L.Uppal: Electrical Wiring, Estimating and Costing by Khanna Publishers.

6EP03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcomes:
After completing this course, student will be able to
1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Unit I: Introduction :
Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD, Introduction to FEM based machine design.

Unit II: Transformer Design –I:
Transformer Core Design - Material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, Minimum losses, Minimum weight & Minimum volume.

Unit III:Transformer Design – II:
Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces ï types & causes.Estimation of efficiency & regulation from design data.
Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC winding Design :
Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction motor stator design:
Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slot-numbers, shape and dimensions, stator teeth dimension, stator core dimensions.Air gap length calculation.

Unit VI: Induction motor rotor design:
Squirrel cage rotor design ï selecting number of rotor slots, design of rotor bars & slots, design of end rings. **Wound type rotor design -** rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design. estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:

1. A. K. Sawhney, ñA Course in Electrical Machine Designò Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, ñPrinciples of Electrical Machine Designò, S.K.Kataria and Sons, Delhi

Reference Books:

1. M.G.Say,ñThe Performance and Design of Alternating Current Machinesò, C.B.S. Pub., Delhi.
2. K.G.Upadhyay,ñDesign of Electrical Machinesò, New Age international Publishers,1st Edition 2008
3. S.K.Sen,ñPrinciples of Electrical Machine Design with Computer Programsò, Oxford and I.B.H. Company Pvt. Ltd., New Delhi
4. IndrajitDasgupta, ñDesign of Transformersò, TMH 1st Edition 2002
5. Indian Standards for Transformer & Three phase IM design from BIS websites.

6EP04 Professional Elective - II
1. ADVANCED CONTROL SYSTEMS

Course Outcome
After completing this course students will be able to

1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.
6. Analyzethe Nonlinear system using Phase plane Analysis

Unit I: Compensation Techniques:
Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead-Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I:
State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition ï Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response ï SISO systems.

Unit III: State Space Technique II:
Concept-controllability and observability , SISO/ MIMO linear Systems Gilbertôs method and Kalmanôs test; SISO controllable Systems design ï state feedback.

Unit IV: Sampled Data Control Systems:
Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Juryôs test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I:
Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: Non-Linear System Analysis II:

Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction ï analytical and graphical method by isoclines, stability analysis, limit cycles, limitations ï phase plane method.

Text Books:

1. Nagrath and Gopal, òControl system Engineeringò Wiley Eastern Ltd , New Delhi
2. K.Ogata,ò Modern Control Theory ñPrentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:

1. Naresh Sinha. ñControl system Engineeringò Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. ñAutomatic Control systemò Prentice Hall Of India Pvt Ltd Delhi
3. D Roy Choudhury, ñModern Control EngineeringòPublisher: PHI Learning.

6EP04 Professional Elective – II:

2. PROCESS CONTROL SYSTEMS

Course Outcomes:

After Completing this course student will be able to

1. Explain the various Electronic Instruments for measurement of electrical parameters.
2. Analyse the different signals
3. Demonstrate the signal counting, recording and working of digital readout devices.
4. Demonstrate the Various techniques of A/D and D/A conversions.
5. Apply various signal processing tools as per requirement
6. Develop ladder diagrams &programmes for PLC

Unit I : Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multi-meter, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

Unit II: Signal Generation and Analysis Signal generators, Function generators. Wave analyzer Harmonic Distortion Analysers, Spectrum Analysis.

Unit III: Signal Counting and Recording Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital display, universal counter, Digital readout devices, storage type CRO, Servo type X-Y recorder.

Unit IV: Signal conditioning and Conversions. Frequency characteristics of various types of signals, active filters bandpass, low pass and high pass filters using opAmps. Various techniques of A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

Unit V: Signal Processing Pulse times, triggered delayed sweeps, discrete pulse delay circuits, pulse sequencing, analog multiplexers and de-multiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

Unit VI : Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

Text Books:

1. H.S. Kalsi ï Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick ï Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

Reference Books: -

1. B.R. Gupta-Electronics and Instrumentation ï Wheeler Publishing.
2. Rangan, Sharma & Mani ï ñInstrumentation ï devices & Systems.ò Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V.Hall,TMH Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney ï A Course in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

6EP04 Professional Elective – II

3. INDUSTRIAL ELECTRICAL SYSTEM

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components.

Unit I: Electrical System Components :
LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse currentcharacteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator,Relays, MPCB, Electric shock and Electrical safety practices

Unit II: Residential and Commercial Electrical Systems:
Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III: Illumination Systems:
Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit IV: Industrial Electrical Systems – I:
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction ï kVAR calculations, type of compensation, Introduction to PCC,MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit V: Industrial Electrical Systems – II:
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing theDG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit VI: Industrial Electrical System Automation:
Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Book: S. L. Uppal and G. C. Garg, ñElectrical Wiring, Estimating & Costingò, Khanna publishers, 2008.

Reference Books:

1. K. B. Raina, ñElectrical Design, Estimating & Costingò, New age International, 2007.
2. S. Singh and R. D. Singh, ñElectrical estimating and costingò, Dhanpat Rai and Co.,
3. Web site for IS Standards.
4. H. Joshi, ñResidential Commercial and Industrial Systemsò, McGraw Hill Education, 2008.

6FEEP05 Open Elective – II
(1) ENERGY AUDIT AND MANAGEMENT

Course Outcomes:
After completing this course student will be able to:

1. Discuss energy scenario and its management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discuss various energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Unit I : Energy Scenario & Management:
Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:
Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Data Analysis-Energyð production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:
Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:
Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:

Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals.

Unit VI: Fundamentals of Harmonics:
Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditions- active reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:
1. S. C. Tripathy, ñUtilization of Electrical Energy and Conservationò, McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press
4. Energy Audit and Conservation TERI

6FEEP05 Open Elective – II (2) ELECTRICAL ESTIMATING & COSTING

Course Outcomes:
After completion of the course students will be able to
1. Understand methods of installation and estimation of service connection
2. Decide type of wiring, its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation:
Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation.
Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection. Estimation of service connection.

Unit II : Residential Building Electrification :
Procedures for designing the circuits and deciding the number of circuits. Selection of type of wiring and rating of wires & cables. Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of commercial Installation:
Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:
Concept of Industrial load. concept of Motor wiring circuit.Important guidelines about power wiring and Motor wiring.Selection and rating of wire, cable size. Sequence to be followed to prepare estimate. Preparations of detailed estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:

Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution:
Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technical sanctions. Billing of executed work.

Text & Reference Books:

1. Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.
2. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi
3. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6FEEP05 Open Elective - II
3. ELECTRICAL MATERIALS

Course outcomes:
After completing this course students will be able to
1. understand importance of electrical engineering materials
2. understand how electric conduction takes place in conductors
3. understand importance of semiconductors and magnetic materials in electrical engineering.
4. understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering.

Unit-I Introduction to Electrical Engineering Materials:
Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials.Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials:
Review of metallic conduction on the basis of free electron theory. variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments,fuses and solder.

Unit-III Semiconductors:
Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials:
Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays.
Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.

Unit-V Dielectrics & Insulating Materials:
Dielectrics, Factors influencing dielectric strength. Capacitor materials. Insulating materials, Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators(transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-VI Materials for Special Applications:
Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text & Reference Books:
1. Electrical Engineering Materials by Dekker A.J (PHI)
2. Electrical Engineering Materials by S.P.Seth (Dhanpatrai and Sons)
3. An Introduction to Electrical Engineering Materials by Dr. C. S Indulkar & Dr. S. Thiruvelgadam (S Chand Publication)

6EP06 POWER ELECTRONICS LAB

Perform minimum eight experiments:
List of Experiments:
1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT
14. To verify the operation of Single phase to single phase cycloconverter
15. To verify the operation of Single phase dual converter With R - RL loads
16. To verify the operation of Single phase ac voltage controller

6EP07 ELECTRICAL ENERGY DISTRIBUTION & UTILIZATION LAB

Perform minimum eight experiments
List of Experiments:
1) Study of Distribution substation equipments.
2) Study of various types of busbar arrangements.
3) Study of Power distribution system.
4) Study of Distribution Automation system.
5) Prepare a report on visit to distribution substation.
6) Simulation of various types of Electrical Distribution System (Radial, Parallel, Ring main)
7) Development of single line diagram of of 33/11 kV substation in AutoCAD Electrical
8) Determination of Efficiency by Performing Load Test on Three-Phase Induction Motor.
9) Determination of Efficiency by Performing Load Test on DC Shunt Motor.
10) Electric Braking of DC.Shunt Motor.
11) Electric Braking of Three-Phase Induction Motor.
12) Speed Control of Three-Phase Slip-Ring Induction Motor.
13) Determination of Efficiency by Performing Load Test on Single-Phase Induction Motor.

14) Study of Electric Heating.
15) Design Scheme of Illumination System.
16) Study of Electric Traction System .

6EP08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB

Develop Minimum Eight Computer Programme:
List of Computer Programme:

1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.
5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.
10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.
11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.
12. Develop a computer programme for stator core design of three phase induction motor.
13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.
14. Develop a computer programme for wound type rotor design of three phase induction motor.
15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EP09 COMPUTER TECHNOLOGY- LAB

Student needs to complete minimum eight assignments based on the following:

- Computer Network: Basic hardware and terminology in networks, Classifications, The Internet, The Intranet and Extranet.
- Installation of operating systems, application software in Personnel Computer or laptop.
- Develop the simulation models for various tasks in electrical engineering using simulation software.
- Develop the computer programme for various tasks in electrical engineering using software.
- Study of PLCs used for Industrial automation & develop the ladder diagram for given task in automation using PLC.
- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

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B.E. COMPUTER SCIENCE & ENGINEERING SEM. V & VI

Syllabus of B.E. Sem. V (Computer Science & Engineering)

5KS01 Database Management Systems (L-4, T-0, C-4)

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:

- To understand the fundamental concepts of database management system.
- To learn database query languages.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To understand the query processing and optimization.
- To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS **Hours: 8**
Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features. (8)

Unit II: Relational Algebra, SQL **Hours: 8**
Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design **Hours: 8**
Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization **Hours: 8**
Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions ,Estimating Statistics of Expression Results, , Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management **Hours: 8**
Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system **Hours: 8**
Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multi-version schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage , early lock release and logical undo operations, , Remote Backup Systems

Text Book: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill

Reference Books:
1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaumôs Outlines)

5KS02 COMPILER DESIGN (L-3, T-0, C-3)

Course Pre-requisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

- To learn concepts of programming language translation and phases of compiler design
- To understand the common forms of parsers.
- To study concept of syntax directed definition and translation scheme for the representation of language
- To illustrate the various optimization techniques for designing various optimizing compilers

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiler **Hours: 06**
Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA.

Unit II: Syntax Analysis **Hours: 07**
Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing **Hours: 07**
Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation **Hours: 07**
Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDDôs: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation **Hours: 07**
Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), Three Address Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation **Hours: 06**

Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education Second Edition.

Reference Books:

1. D. M. Dhamdhere, Compiler Constructionð Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press.
4. K C. Louden ñCompiler Constructionð Principles and Practiceò India Edition, CENGAGE.
5. Bennett J.P., ñIntroduction to Compiling Techniquesò, 2/e (TMH).

5KS03 COMPUTER ARCHITECTURE & ORGANIZATION (L-3, T-0, C-3)

Course Pre-requisite: Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following:

- To discuss the basic concepts and structure of computers.
- To solve concepts of arithmetic operations.
- To understand addressing modes and memory organization.
- To analyze conceptualize multitasking ability of a computer and pipelining
- To explain IO communication

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer **Hours: 7**

Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.

Unit II: Memory Unit **Hours: 7**

Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit **Hours: 8**

Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization **Hours:6**

Accessing I/O Devices, Interrupts, Enabling and Disabling Inerrupts, Handling Multiple Devices, DMA,I/O Hardware, Standard I/O Interfaces:SCSI

Unit V: Arithmetic **Hours: 7**

Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers ,Booth Multiplier, Fast Multiplication ,Integer Division, Floating Point Numbers and Operations.

Unit VI: Parallel Organization and Pipelining **Hours: 7**

Parallel Processing, Array Processors, The Structure of General Purpose Multiple Processors, Symmetric, Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Memory Organization in Multiprocessors. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Text Book: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, ñComputer Organizationò, Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, ñComputer Organization and Architecture: Designing for Performanceò, Eighth Edition, Pearson.
   John P. Hayes, ñComputer Architecture and Organizationò, McGraw Hill Publication.
2. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
3. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

5KS04 COGNITIVE TECHNOLOGIES (L-3, T-0, C-3)

Course Prerequisite: Basic knowledge of Artificial Intelligence, Programming and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cognitive Technologies by being able to do each of the following:

- This course intends to introduce concept of cognitive technologies and important approaches of cognitive technologies.
- Student will learn and analyze key concept of cognitive technologies.
- Students will gain an understanding of innovation concepts, terminology, current and future trends in cognitive technologies.
- Introduces students to IBM Watson platform, an artificially intelligent computer system capable of answering questions posed in natural language, developed in IBMös Deep QA project.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe the Cognitive computing and principles of cognitive systems.
2. Identify role of Natural Language Processing in cognitive system.
3. Outline application of advanced analytics in cognitive computing.
4. Justify role of Cloud and Distributed Computing in Cognitive Computing.
5. Assess the process of building a Cognitive Application.
6. Identify the Emerging Areas and Future Applications of Cognitive Computing.

Unit I: Foundation of Cognitive Computing & Design Principle of Cognitive Systems Hours: 07
The Foundation of Cognitive Computing: Cognitive Computing as a New Generation, The Uses of Cognitive Systems, What Makes a System Cognitive, Gaining Insights from Data, Domains Where Cognitive Computing Is Well Suited, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, Two Systems of Judgment and Choice, Understanding Complex Relationships Between Systems, The Elements of a Cognitive System, Infrastructure and Deployment Modalities.
Design Principles for Cognitive Systems: Components of a Cognitive System, Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.

Unit II: NLP and Big Data in Cognitive System Hours: 07
Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems.
The Relationship Between Big Data and Cognitive Computing**:** Dealing with Human-Generated Data, Defining Big Data, The Architectural Foundation for Big Data, Analytical Data Warehouses, Hadoop, Data in Motion and Streaming Data, Integration of Big Data with Traditional Data.

Unit III: Knowledge Representation and Advance Analytics in Cognitive Computing Hours: 06
Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Developing a Cognitive System, Defining Taxonomies and Ontologies, Explaining How to Represent Knowledge, Models for Knowledge Representation. Applying Advanced Analytics to Cognitive Computing: Advanced Analytics Is on a Path to Cognitive Computing, Key Capabilities in Advanced Analytics, Using Advanced Analytics to Create Value, Impact of Open Source Tools on Advanced Analytics.

Unit IV: Role of Cloud and Distributed Computing in Cognitive Computing Hours: 07
The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Why Cloud Services Are Fundamental to Cognitive Computing Systems, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Data Integration and Management in the Cloud.
The Business Implications of Cognitive Computing: Preparing for Change, Advantages of New Disruptive Models, What Does Knowledge Mean to the Business?, The Difference with a Cognitive Systems Approach, Meshing Data Together Differently, Using Business Knowledge to Plan for the Future, Answering Business Questions in New Ways, Building Business Specific Solutions, Making Cognitive Computing a Reality, How a Cognitive Application Can Change a Market.

Unit V: IBM Watson and Process of Building a Cognitive Application Hours: 07

IBMös Watson as a Cognitive System: Watson Defined, Advancing Research with a ñGrand Challengeò, Preparing Watson for Jeopardy, Preparing Watson for Commercial Applications, The Components of DeepQA Architecture.
The Process of Building a Cognitive Application: The Emerging Cognitive Platform, Defining the Objective, Defining the Domain, Understanding the Intended Users and Defining their Attributes, Defining Questions and Exploring Insights, Creating and Refining the Corpora, Training and Testing.
Building a Cognitive Healthcare Application: Foundations of Cognitive Computing for Healthcare, Constituents in the Healthcare Ecosystem, Learning from Patterns in Healthcare Data, Building on a Foundation of Big Data Analytics, Cognitive Applications across the Healthcare Ecosystem, Starting with a Cognitive Application for Healthcare, Using Cognitive Applications to Improve Health and Wellness, to Enhance the Electronic Medical Record and to Improve Clinical Teaching.

Unit VI: Emerging Areas and Future Application **Hours: 06**
Smarter Cities: Cognitive Computing in Government: How Cities Have Operated, The Characteristics of a Smart City, The Rise of the Open Data Movement Will Fuel Cognitive Cities, The Internet of Everything and Smarter Cities, Understanding the Ownership and Value of Data, Smarter Approaches to Preventative Healthcare, Building a Smarter Transportation Infrastructure, Using Analytics to Close the Workforce Skills Gap, Creating a Cognitive Community Infrastructure, The Next Phase of Cognitive Cities.
Emerging Cognitive Computing Areas: Characteristics of Ideal Markets for Cognitive, Computing Vertical Markets and Industries.
Future Applications for Cognitive Computing: Requirements for the Next Generation, Technical Advancements That Will Change the Future of Cognitive Computing, What the Future Will Look Like, Emerging Innovations.

Text Book:
Judith Hurwitz, Marcia Kaufman and Adrian Bowles, "Cognitive Computing and Big Data Analytics", publication John Wiley & Sons, Inc, 2015.

Reference Books:
1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, publication Cambridge University Press, New York, Second Edition.
2. Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, Inc. London, 2014.
3. Huimin Lu (Editor), Cognitive Internet of Things: Frameworks, Tools and Applications, Springer Nature Switzerland AG 2020.
4. Danish Contractor and Aaditya Telang (Editors), Applications of Cognitive Computing Systems and IBM Watson, 8th IBM Collaborative Academia Research Exchange, publication Springer Nature Singapore Pte Ltd., 2017.
5. S. Bird, E. Klein, E. Loper (2009), Natural Language Processing with Python, OôReilly Media.

5KS04 DATA SCIENCE AND STATISTICS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:
- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

Unit I: Data Science and Statistical Learning **Hours: 6**
Introduction: What Is Data Science?, Statistical Inference, Exploratory Data Analysis, and the Data Science Process, Exploratory Data Analysis, Stages of a Data Science Project, The Data Science Process, Why Statistical Learning: f Estimation- Why and How, Tradeoff Between Prediction Accuracy and Model Interpretability, Supervised vs Unsupervised Learning, Regression vs Classification Problems, Accessing Model Accuracy: Measuring the Quality of Fit, The Bias Variance Trade-off, The Classification Setting.

Unit II: Linear Regression **Hours: 7**
Simple Linear Regression: Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Assessing the Accuracy of the Model, Multiple Linear Regression: Estimating the Regression Coefficients, Other Considerations in the Regression Model: Qualitative Predictors, Extensions of the Linear Model, Potential Problems, The Marketing Plan, Comparison of Linear Regression with K-Nearest Neighbors.

Unit III: Classification and Cross Validation **Hours: 7**
Classification: An Overview of Classification, Why not Linear Regression?, Logical Regression: The Logistic Model, Regression Coefficients, Making Predictions, Multiple Logistic Regression, >2 Response Classes, Linear Discriminant Analysis: Using Bayesô Theorem, LDA for p = 1 and p >1, Quadratic Discriminant Analysis, Comparison of Classification Methods, Cross Validation: The Validation Set Approach, Leave-One-Out and k-Fold Cross-Validation, Bias-Variance Trade-Off for k-Fold Cross-Validation, Classification Problems, The Bootstrap

Unit IV: Linear Model Selection and Regularization **Hours: 6**
Subset Selection: Best Subset Selection, Stepwise Selection, Choosing the Optimal Model, Shrinkage Methods: Ridge Regression, The Lasso, Selecting the Tuning Parameter, Dimension Reduction Methods: Principal Components Regression, Partial Least Squares, Considerations in High Dimensions: High-Dimensional Data, What Goes Wrong in High Dimensions?, Regression in High Dimensions, Interpreting Results in High Dimensions

Unit V: Nonlinearity and Tree Based Methods **Hours: 7**

Moving Beyond Linearity: Polynomial Regression, Step Functions, Basis Functions, Regression Splines: Piecewise Polynomials, Constraints and Splines, Representation, Number and Locations of the Knots, Comparison to Polynomial Regression, Smoothing Splines: An Overview and Smoothing
Parameter λ, Local Regression, Generalized Additive Models: Regression Problems and Classification Problems, Tree-Based Methods: Decision, Regression and Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting

Unit VI: SVM and Unsupervised Learning **Hours: 7**

Maximal Margin Classifier: Hyperplane and Classification, The Maximal Margin Classifier, Construction, The Non-separable Case, Support Vector Classifiers: Overview and Details, Support Vector Machines: Classification with Non-linear Decision Boundaries, SVM, Application, SVMs with More than Two Classes, Relationship to Logistic Regression, Unsupervised Learning: The Challenge of Unsupervised Learning: Principal Components Analysis, Clustering Methods: K-Means Clustering, Hierarchical Clustering, Practical Issues in Clustering.

Text Books:

1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0.

Reference Book:

Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

5KS04 INTERNET OF THINGS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Internet and Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Internet of Things by being able to do each of the following:

- To learn and understand fundamental of IoT
- To study the design methodology and different IoT platform
- To understand usefulness of IoT for society
- To design and implement application of IoT using various sensor

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand the basics of IoT
2. Understand design methodology and platforms involved in IoT
3. Apply the knowledge to interface various sensors with IoT development
4. Design and Implement IoT system for real time application

Unit I: **Hours: 6**

Introduction to Internet of Things, Definition & Characteristics of IoT, Physical Design of IoT Logical Design of IoT, IoT Enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels & Deployment Templates, Domain Specific IoTs: Home, Cities, Environment, Energy systems, Logistics, Agriculture, Health & Lifestyle.

Unit II: **Hours: 7**

IOT & M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software defined networks, network function virtualization, IoT Systems Management, Simple Network Management Protocol (SNMP) ,Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG, NETOPEER.

Unit III: **Hours: 7**

IoT Platforms Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, IoT Systems - Logical Design using Python ,Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling l, Date/Time Operations, Classes, Python Packages of Interest for IoT

Unit IV: (**Hours: 7)** IoT Physical Devices & Endpoints, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces serial, SPI, I2C, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and switch with Raspberry Pi, Interfacing Light Sensor with Raspberry Pi Other IoT Devices, pcDuino, BeagleBone Black, Cubieboard.

Unit V: **Hours: 7**

IoT Physical Servers & Cloud Offerings, Introduction to Cloud Storage Models & Communication APIs , WAMP - AutoBahn for IoT , Xively Cloud for IoT , Python Web Application Framework - Django , Designing a RESTful Web API , Amazon Web Services for ,SkyNet IoT Messaging Platform.

Unit VI: **Hours: 7**
Case Studies Illustrating IoT Design, Introduction, Home Automation: Smart Lighting, Home Intrusion detection, Cities: Smart parking, Environment: Weather Monitoring System, Weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture: Smart Irrigation, Productivity Applications: IoT printer.

Text Book: Arshdeep Bahga, Vijay Madisetti, ñInternet of Things ï A hands-on approachò, Universities Press, ISBN:0: 0996025510, 13: 978-0996025515.

Reference Books:
1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012.
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ñFrom Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligenceò, 1st Edition, Academic Press, 2014

5KS04 INTRODUCTION TO CYBER SECURITY [L-3, T-0,C-3]

Course Prerequisite: Computer Programming, Data Structure, Data Communication & Networking.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Introduction to Cyber Security by being able to do each of the following:
- Understand basics of Cybercrime and Information Security.
- To familiarize various cyber threats, attacks, Cyber offenses.
- Understand Cybercrime on Mobile and Wireless devices.
- Understand tools and methods used in Cybercrime.
- Understand Access Control and Authentication.
- Understand Intrusion Detection and Prevention.

Course Outcomes (Expected Outcome): After completion of this course, the students should be able to:
1. Know fundamentals of Cybercrimes and Cyber offenses
2. Realize the Cyber threats, attacks and Vulnerabilities.
3. Explore the industry practices and tools.
4. Comprehend the Access Control and Authentication Process.
5. Implement Intrusion Detection and Prevention.

Unit I: **Hours:6**
Introduction to Cybercrime: Introduction, Cybercrime, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Unit II: **Hours: 6**
Cyber offenses: Introduction, Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrime, Botnets, Attack Vector, Cloud Computing.

Unit III: **Hours: 6**
Cybercrime: Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.

Unit IV: **Hours: 6**
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit V: **Hours:6**
Access Control and Authorization: Definitions, Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization.
Authentication: Definition, Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentication, Authentication Methods.

Unit VI: (**Hours: 6)** System Intrusion Detection and Prevention: Definition, Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools
Disaster Management: Introduction, Disaster Prevention, Disaster Response, Disaster Recovery, Make your Business Disaster Ready, Resources for Disaster Planning and Recovery.

Text Books:

1. Nina Godbole, Sunit Belapure, ñCyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectivesò, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791,2013
2. Joseph Migga Kizza, ñA Guide to Computer Network Securityò, Springer 2009.

Reference Books:

1. V.K. Pachghare, ñCryptography and information Securityò, PHI Learning Private Limited, Delhi India.
2. Nina Godbole, ñInformation Systems Securityò, Wiley India, New Delhi
3. Kennetch J. Knapp, ñCyber Security & Global Information Assuranceò, Information Science Publishing.
4. James Graham, Richard Howard, Ryan Olson, ñCyber Security Essentialsò CRC Press.
5. Jeetendra Pande, ñIntroduction to Cyber Securityò Uttarakhand Open University, 2017

5KS05 PRINCIPLES OF MARKETING FOR ENGINEERING [L-3, T-0, C-3]

Course Pre-requisite: Basic knowledge of Computers.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Principles of Marketing for Engineering by being able to do each of the following:

- To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success;
- To develop a digital marketing plan; to make SWOT analysis;
- To define a target group; to introduced to various digital channels, their advantages and ways of integration;
- To integrate different digital media and create marketing content to manage a digital marketing performance efficiently.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Identify the importance of the digital marketing for marketing success,
2. Manage customer relationships across all digital channels and build better customer relationships,
3. Create a digital marketing plan, starting from the SWOT analysis and defining a target group,
4. Identify digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget

Unit I: Introduction to e-Marketing: **Hours: 7**

Introduction, Wired-up world, B2C, B2B, C2B and C2C Model, Objectives: Sell, Serve, Speak, Save, Sizzle, Introduction to e-strategy.

Unit II: Remix and e-Models **Hours: 7**

Introduction to Remix: Product, Price, Place, Promotion, People, Process. Introduction to e-Models, e-Marketplace, Digital Communication market, Web & Social Network Models, Customer buying models, Loyalty models

Unit III: e-Customers **Hours: 7**

Introduction to e-Customers, Motivations, Expectations, Fears & Phobias, Online Buying Process, information processing, relationship & royalty, Communities & social networks, Customer profiles

Unit IV: e-Tools & Site Design **Hours:7**

Introduction to e-Tools, Technology development & customer impact, Interactive digital TV, Digital Radio, Mobile Devices, Interactive self-service kiosks, Convergence, Integrated Campaigns, Web-site design, Integrated design, online value proposition, Dynamic & aesthetics design

Unit V: Traffic Building **Hours: 7**

Search Engine Marketing, Online PR & Partnerships, Interactive Advertising, e-mail & viral marketing, Online traffic building, Control, Resourcing

Unit VI: e-CRM & e-Business **Hours: 7**

Introduction to e-CRM, Database marketing, e-CRM, Profiling, Personalization, Introduction to e-Business, e-Business Architecture & framework, e-business security.

Text Book: E-Marketing excellence: Planning & Optimizing your Digital Marketing, Dave Chaffey & P R Smith, 3rd Edition, Butterworth-Heinemann, Elsevier.

Reference Books:

1. Marketing 4.0: Moving from Traditional to Digital, Philip Kotler, H. Kartajaya, I. Setiawan, Wiley.
2. Business Marketing and Management Principles for IT and Engineering, D. N. Chorafas, CRC Press.
3. Marketing Management, Philip Kotler, Kevin Keller, 12th Edition, Pearson Prentice Hall.
4. Marketing Insights from A to Z, Philip Kotler, John Wiley & Sons..

5KS05 Open Elect. I (i) FUNDAMENTALS OF FINANCE & ACCOUNTING [L-3, T-0, C-3]

Course Prerequisite: Basic Knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Fundamentals of Finance & Accounting by being able to do each of the following:

- Know and apply accounting and finance theory
- Critically evaluate financial statement information
- Evaluate and compare different investments

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Define bookkeeping and accounting
2. Explain the general purposes and functions of accounting
3. Explain the differences between management and financial accounting
4. Describe the main elements of financial accounting information ï assets, liabilities, revenue and expenses
5. Identify the main financial statements and their purposes.

Unit I: The basics of Accounting I **Hours: 7**
The Assets, Liabilities and Balance Sheets, Procedure for creating a Balance Sheet, Different forms of Balance Sheet, Basic concepts of Accounting
Unit II: The basics of Accounting II **Hours: 7**
The Profit & Loss Account, Cash Flow Statement, Creating Profit & Loss Account, Creating Cash Flow Statement, Book Keeping Basic terminology, Debt & Credit Convention
Unit III: Interpretation of Accounts **Hours: 8**
Accounting Rules, Reports, Assets, Liabilities, ShareholdersôEquity, P&L Statement,
Unit IV: Introduction to Financial Management **Hours:6**
What is Finance, Forms of Business Organization, Stock Price & Shareholder Value, Intrinsic Value, Stock Price, Business trends and ethics, Conflicts management.
Unit V: Financial Markets and Institutions **Hours: 7**
Financial Markets, Capital Allocation, Financial Institutions, Stock Market, Market for Common Stock, Stock Market Returns, Stock Market Efficiency
Unit VI: Financial Statements & Analysis **Hours: 7**
Financial Statements & Reports, Stockholdersô Equity, Free Cash Flow, Income Taxes, Analysis of Financial Statements: Ratio Analysis, Liquidity Ratios, Asset & Debt Management Ratio, Profitability Ratio, Trend Analysis

Text Books:
1. Accounts Demystified, 5th Edition, Anthony Rice, Pearson ï Prentice Hall
2. Fundamentals of Financial Management, 6th Edition, E. F. Brigham, J.F. Houston, Cengage Learning.

Reference Books:
1. Engineering Economics: Financial Decision Making for Engineering, N. M. Fraser, E. M. Jewkes, 5th Edition, Pearson Publication.
2. Financial Fundamentals for Engineers, Richard Hill & George Slot, Butterworth-Heinemann, Elsevier.
3. Financial Accounting, Jerry Weygandt, Paul Kimmel, Donald Kieso, 9th Edition, Wiley
4. Financial Accounting: Tools for Business Decision Making, Jerry Weygandt, Paul Kimmel, Donald Kieso, 6th Edition, Wiley Plus.

5KS05 ENTREPRENEURSHIP [L-3,T-0,C-3]

Course Prerequisite:
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Entrepreneurship by being able to do each of the following:
- Understand basic concepts in the area of entrepreneurship
- Understand the role and importance of entrepreneurship for economic development
- Develop personal creativity and entrepreneurial initiative,
- Adopt the key steps in the elaboration of business idea

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:
1. Analyse the business environment in order to identify business opportunities,
2. Identify the elements of success of entrepreneurial ventures,
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Specify the basic performance indicators of entrepreneurial activity,
5. Explain the importance of marketing and management in small businesses venture,
6. Interpret their own business plan.

Unit I: **Hours:6**
Introduction to Entrepreneurship: Introduction, Common Myths About Entrepreneurs, Types of Start- Up Firms, Changing Demographics of Entrepreneurs, Entrepreneurship Importance.
Recognizing Opportunities and Generating Ideas: Identifying and Recognizing Opportunities, Finding Gaps in the Marketplace, Techniques for Generating Ideas, Encouraging and Protecting New Ideas.
Unit II: **Hours:6**
Feasibility Analysis: Product/Service Feasibility Analysis, Industry/Target Market Feasibility Analysis, Organizational Feasibility Analysis and Financial Feasibility Analysis.
Writing A Business Plan: The Business Plan, Outline of the Business Plan, Presenting the Business Plan to Investors.
Unit III: **Hours:6**
Industry and Competitor Analysis: Industry Analysis, Industry Trends, The Five Competitive Forces Model, The Value of the Five Forces Model, Industry Types and the Opportunities, Competitor Analysis, Identifying Competitors, Sources of Competitive Intelligence, Completing a Competitive Analysis Grid. Developing an Effective Business Model: Business Models, Components of an Effective Business Model.

Unit IV: **Hours: 6**
Ethical and Legal Foundation: Initial Ethical and Legal issues facing a New Firm, Drafting a Founders Agreement, Avoiding Legal Disputes, Business Licenses and Permits, Choosing a Form of Business Organization.
Assessing A New Ventureọs Financial Strength and Viability: Introduction to Financial Management, Financial Statements and Forecasts, Pro forma Financial Statements.
Unit V: **Hours: 6**
New Venture Team: Creating a New-Venture Team, Rounding out the Team: The Role of Professional Advisers.
Getting Financing or Funding: The Importance of Getting Financing or Funding, Sources of Equity Funding, Sources of DEBT Financing, Creative Sources of Financing and Funding.
Unit VI: **Hours:6**
Unique Marketing Issues: Selecting a Market and Establishing a Position, Key Marketing issues for New Ventures, The 4Ps of Marketing for New Ventures.
The Importance of Intellectual Property: The Importance of Intellectual Property, Patents, Trademarks, Copyrights, Trade Secrets, Conducting an Intellectual Property Audit.

Text Book: Bruce R. Barringer, R. Duane Ireland, ñEntrepreneurship Successfully Launching New Venturesò, Pearson Education, Third Edition.

Reference Books:

1. Ram Chandran, ñEntrepreneurial Developmentò, Tata McGraw Hill, New Delhi
2. Khanka, S S. ñEntrepreneurial Developmentò, S Chand & Company Ltd. New Delhi
3. Badhai, B ñEntrepreneurship for Engineersò, Dhanpat Rai & Co. (p) Ltd.
4. Gupta and Srinivasan, ñEntrepreneurial Developmentò, S Chand & Sons, New Delhi.
5. Arya Kumar, Entrepreneurship, Pearson, Delhi
6. Poornima MCH, Entrepreneurship Development ï Small Business Enterprises, Pearson, Delhi
7. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
8. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi

5KS06 DATABASE MANAGEMENT SYSTEMS LAB [P-2, C-1]

Course Prerequisite: Basic concept of programming, Basic concepts of data structures
Course Objectives:
- To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
- To study the primary data model (relational model) for commercial data processing applications.
- To study the standard structured query language and retrieve the information from the database in various ways.
- To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome) On completion of the course, the students will be able to
1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

Practical 1: To Study a Database Modeling Tool.
Study of Data Modeling Tools:
Å Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
Å Logical / Physical Modeling
Å Adding an entity / its attributes, relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
Å Forward / reverse engineering
Å Details of forward engineering / schema generation
Å Steps to generate the schema

Practical 2: To Study and implement DDL Commands
Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.
- Creating the proper tables
- Insert the data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I
Å SQL queries : Write and execute different SQL queries
Å Execute Simple queries using SELECT, FROM, WHERE clauses,
Å In Where clause use different predicates involving OR,AND, NOT
Å Rename operation
Å Tuple Variables
Å Write SQL for various String operations (%,_,*)
Å Match beginning with
Å Match ending with
Å Substring
Å Match exactly n characters
Å Match at least n characters
Å Sort the output of the query using Order by
Å Write SQL using Having

Practical 4 : To Study and implement DML Commands-II Write SQL queries and perform
Å Set membership operations
Å In, not in
Å Some
Å All
Å Exists and not exists, Test for emptyness using exists, not exists
Å Test for absence of duplicates.
Å Nested queries

Practical 5. Study and implement aggregation functions.
- Write different queries using following Aggregate functions
- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.
Practical 7: Write SQL to perform the modifications to the database
Practical 8 : PL /SQL
Practical 9 : Database Access Using Cursors
Write a trigger to find the names and cities of customers who have more than xyz in any account.
Practical 10 : Triggers
Å Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
Å Write a trigger for dealing with blank cities (set the city field to null when it is blank)

Practical 11: Procedures, functions
Å Write atleast 2 functions, and demonstrate its use
Å Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)
HTTP, A Simple Example, Printing HTML Tables., Passing Parameters, Processing HTML Forms., Multi-Valued Parameters.
Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)
Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents beyond Syllabus)
A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.
Practical 15: PHP : Develop a simple application to access the database using PHP (Contents beyond Syllabus)
Study of Open Source NoSQL Databases
Based on the concepts covered in text create a Mini Project:

Suggested Topics:
i. Bank database (Given in Korth book)
ii. University Database (Given in Korth book)
iii. Airline Flight Information System.
iv. Library Database Application.
v. University Student Database.
vi. Video Chain Database.
vii. Banking Database.
viii. BiBTeX Database.
ix. Music Store Database.
x. Online Auctions Database.
xi. A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books: (may be 5 to 6)
1. Kevin Roebuck, ñStoring and Managing Big Data - NoSQL, HADOOP and Moreò, Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, ñMangoDB: The Definitive Guideò ,O'Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, ñNoSQL For Dummiesò, John Wiley & Sons, ISBN-1118905628
4. C J Date, ñAn Introduction to Database Systemsò, Addison-Wesley, ISBN: 0201144719.

5KS07 COMPILER DESIGN – Lab [P-2, C-1]

Course Prerequisite: Basic knowledge of C Programming, Data Structures, Theory of Computation.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:
- Know the basic components of a Compiler.
- To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool.
- To implement various parsing methods.
- To implement code optimization techniques .

Course Outcomes (Expected Outcome):

On completion of the course, the students will be able to
1. Identify the fundamentals of compiler and its phases.
2. Use the powerful compiler generation tools such as Lex and Yacc.
3. Write a lexical scanner, either from scratch or using Lex.
4. Develop program for solving parser problems.
5. Examine the various optimization techniques.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Implement a C program to check parenthesis of regular expression is balanced or not.
4. Implement a C program to construct NFA from regular expression.
5. Implement a C program to simulate Deterministic Finite Automation (DFA) for a string which ending with ‘a’, ‘a*b+’, ‘abb’.
6. Write a C program to construct of DFA from NFA.
7. Implement a Lex program to verify the parenthesis of a given expression is balanced.
8. Implement a Lex program to recognize the token like Digit, Identifier & Delimiter.
9. Implement the Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
10. Implement a Lex program to a valid arithmetic expression and to recognize the identifier and operators present.
11. Implement a Lex program to count words, characters, lines, vowels and consonants from given input.
12. Implement a Lex program to check given number is positive negative or zero.
13. Implement a Lex program to generate string which is ending with zeros.
14. Implement LEX and Yacc tool to implement desk calculator.
15. Write a C program for constructing of SLR parsing.
16. Write a C program for constructing of LL (1) parsing.
17. Write a C program for constructing of LALR parsing.
18. Write a C program for constructing recursive descent parsing.
19. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
20. Write a C program for Tokenizing the file which reads a source code in C/C++ from an unformatted file and extract various types of tokens from it
21. Write functions to find FIRST and FOLLOW of all the variables / given grammar.
22. Implement a Shift Reduce Parser for the following productions.
23. E Ÿ E+E / E*E / a / b
24. Implement a symbol table containing functions create(), modify(), search(), display() and delete().
25. Implement three address Code for the input a=b*c.
26. Implement Recursive Decent Parser for the productions.

List of Experiments beyond Syllabus: (Maximum 05)
1. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
2. Write a C program to generate machine code from abstract syntax tree generated by the parser.
3. Write a Lex program to find out total number of vowels, and consonants from the given input string.
4. Implementation of Finite State machines DFA, NFAs .
5. Computation of Leading & Trailing Sets.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education, Second Edition.

Reference Books:

1. Doug Brown, John Levine, and Tony Mason, ñLex & Yaccò, OöReilly & Associates, Inc., Second Edition.
2. Andrew Appel, ñModern Compiler Implementation in Cò, Cambridge University press.
3. K C. Louden ñCompiler Construction - Principles and Practiceò India Edition, CENGAGE.
4. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs and Koen Langendoen, ñModern Compiler Designò, Second Edition, John Wiley & Sons Publication.
5. Keith Cooper and Linda Torczon, ñEngineering: A Compilerò, Second Edition, Morgan Kaufmann Publication.

5KS09 C-Skill Lab – III [P-2, C-1]

Course Prerequisite: Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

- To develop an ability to set up a local JS Library/Framework development Environment.
- To be able to install and implement different JS Libraries and Frameworks
- To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the ñupper-caseò package of NPM.
7. To study event handling in Node.js and demonstrate it using event module and EventEmitter object.
8. To study and implement the Formidable module of Node.js to upload the file on the server.
9. To study and implement the Nodemailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using ñINSERTò statement and Node.js
13. To demonstrate the display of records from the MySQL database using ñSELECTò statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using ñWHEREò statement using Node.js
15. To demonstrate deletion of records from database using ñDELETEò statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

1. Create an Email sender app using Node.js
2. Create an Basic User database: Site in which User can Sign up/Login and can see other Userös Profile Information.
3. Create a User model covering Registration, Email verification(send an email), login (with remember me, display user details and allow to save/update user details(DOB, Location, Hobbies etc or anything)
4. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, OöReilly .

Reference Books:

1. ShyamSeshadri: Angular Up and Running, OöReilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, OöReilly

5KS08 EMERGING TECHNOLOGY LAB I

5KS08 Emerging Technology Lab 1 is based on 5KS04 Professional Elective-I. Tentative FOSS Tools & Technology for Practicalôs are as follows:

AI : IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph

DS :R, Python, Cassandra, Apache Hadoop,

IoT : Arduino, DeviceHive, Kaa, Home Assistant

Cyber Security: Kali Linux, OpenVPN, NMAP, Metasploit Framework

5KS08 DATA SCIENCE AND STATISTICS – LAB [P-2, C-1]

Course Prerequisite: Basic knowledge of Mathematics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus:

Introduction to R:

[1] To learn and implement the Basic Commands and Graphics in R
[2] To perform Indexing and Loading Data

Linear Regression:

[3] To learn different Libraries in R and To perform Simple Linear Regression and Multiple Linear Regression
[4] To learn Interaction Terms and to perform Non-linear Transformations of the Predictors
[5] To learn and evaluate Qualitative Predictors
[6] To learn to Write Functions

Logistic Regression, LDA, QDA, and KNN

[7] To perform Logistic Regression
[8] To perform Linear Discriminant Analysis
[9] To perform Quadratic Discriminant Analysis
[10] To implement K-Nearest Neighbors technique
[11] To use Caravan Insurance Data for LR, LDA, QDA, and KNN

Cross-Validation and the Bootstrap

[12] To learn and perform The Validation Set Approach
[13] To learn and perform Leave-One-Out Cross-Validation
[14] To learn and perform k-Fold Cross-Validation
[15] To learn and perform The Bootstrap

Subset Selection Methods

[16] To learn and perform Best Subset Selection
[17] To learn and perform Forward and Backward Stepwise Selection
[18] To learn to Choose Among Models Using the Validation Set Approach and Cross-Validation

Ridge Regression and the Lasso

[19] To learn and perform Ridge Regression
[20] To learn and perform The Lasso

PCR and PLS Regression

[21] To learn and perform Principal Components Regression
[22] To learn and perform Partial Least Squares

Non-linear Modeling

[23] To learn and perform Polynomial Regression and Step Functions
[24] To learn and perform Splines
[25] To learn and perform GAMs

Decision Trees
[26] To learn and perform Fitting Classiýcation Trees
[27] To learn and perform Fitting Regression Trees
[28] To learn and implement Bagging and Random Forests
[29] To learn and perform Boosting
Support Vector Machines
[30] To learn and perform Support Vector Classiýer
[31] To learn and perform Support Vector Machine
[32] To learn and perform ROC Curves
[33] To learn and perform SVM with Multiple Classes
[34] To use Gene Expression Data
Clustering
[35] To implement K-Means Clustering
[36] To implement Hierarchical Clustering
NCI60 Data Example
[37] To implement PCA on the NCI60 Data
To Cluster the Observations of the NCI60 Data

List of Experiments beyond Syllabus: (Maximum 05)

1. To implement the Association Rules
2. To implement the kernel method to increase data separation
3. Develop a data model and deploy it as R HTTP Services or by export
4. Develop a data model and present it to end user with proper presentations
5. Carry out your assigned task and present it to other data scientist with proper presentations

Text Books:
1. Cathy OÕNeil and Rachel Schutt: Doing Data Science, First Edition, 2014, OÕreilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0

Reference Book:
Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

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6KS01 SECURITY POLICY & GOVERNANCE [L-3, T-0, C-3]

Course Prerequisite: Data Communication and Networking,

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Security Policy & Governance by being able to do each of the following:
1. Understand the legal and regulatory environment and its relationship to Information Security.
2. Understand Information Security Concepts.
3. Understand the role of Information Security governance and planning within the organizational context.
4. Understand how to develop, implement and maintain various types of Information Security policies.
5. Understand risk management and its role in the organization.
6. Understand how to identify risk control classification categories

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. List and discuss the key characteristics of Information Security, Leadership and Management
2. Differentiate between Law and Ethics
3. Describe why ethical codes of conduct are important to Information Security
4. Discuss the importance, benefits and desired outcomes of Information Security Governance
5. Discuss the process of developing, implementing and maintaining various types of Information Security Policies.
6. Define Risk Management and its role in the organization.

Unit I: Hours:6
Introduction to the Management of Information Security: Introduction to Security, Key Concepts of Information Security: Threats and Attacks, Management and Leadership, Principles of Information Security Management.
Unit II: Hours:6
Compliance: Law and Ethics: Introduction to Law and Ethics, Ethics in information Security, Professional Organizations and Their Codes of Conduct, Information Security and Law Organizational Liability and the Management of Digital Forensics.
Unit III: Hours:6
Governance and Strategic Planning for Security: The Role of Planning, Strategic Planning, Information Security Governance, Planning for Information Security Implementation.

Unit IV: Hours:6
Information Security Policy: Policy, Enterprise Information Security Policy, Issue-Specific Security Policy, System-Specific Security Policy, Guidelines for Effective Policy Development and Implementation.
Unit V: Hours:6
Risk Management: Assessing Risk: Introduction to the Management of Risk in Information Security, The Risk Management Process.
Unit VI: Hours:6
Risk Management: Treating Risk: Introduction to Risk Treatment, Managing Risk, Alternative Risk Management Methodologies.
Text Book: Michael E. Whitman, Herbert J. Mofford, ñManagement of Information Securityò Sixth Edition, Cengage Learning, 2016.

Reference Books:
[1] Robert F Smallwood, ñInformation Governance for Business Documents and Recordsò Wiley 2014
[2] Michael E. Whitman and Herbert J. Mofford, ñPrinciples of Information Securityò Sixth Edition, Cengage Learning, 2018
[3] Krag Brotby, ñInformation Security Governance: A Practical Development and Implementation Approachò 2009 by John Wiley & Sons.
[4] Brijendra Singh, ñNetwork Security and Managementò Second Edition, PHI.
[5] Alan Calder and Steve Watkins, ñIT Governance an international guide to data security and ISO27001/ISO27002ò 2015, Kogan Page Limited.
[6] Evan Wheeler, ñSecurity Risk Management, Building an Information Security Risk Management Program from the Ground Upò 2011, Syngress publications.
[7] Mike Chapple, James Michael Stewart and Darril Gibson, ñCISSP® Certified Information Systems Security Professional Official Study Guideò Eighth Edition, 2018, John Wiley & Sons.

6KS02 DESIGN AND ANALYSIS OF ALGORITHMS [L-4, T-0, C-4]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue: Hours: 8
Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion
Unit II: Divide And Conquer Hours: 8
Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.
Unit III: Greedy Methods Hours: 8
Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Primôs Algorithms, Kruskalôs Algorithm, Dijkstras Shortest Path Algorithm.
Unit IV: Dynamic Programming Hours: 8
Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.
Unit V: Backtracking Hours: 8
Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.
Unit VI: Efficiency of Algorithm Hours: 8
Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education.

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KS03 SOFTWARE ENGINEERING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Programming Languages.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.
6. To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome): On completion of the course, student will be able toï
1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

Unit I: Introduction to Software Engineering, Software Process Models Hours: 6
Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping ,RAD ,Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice
Unit II: Project Management: Process, Metrics, And Estimations & Risks Hours:6
Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks: identification, risk projection, refinement & RMMM plan

Unit III: Project Scheduling & Quality Management Hours: 6
Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering Hours:6
System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design Hours: 6
Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing Hours: 6
Software testing fundamentals; test case design, White box testing. Basis path, control structure-, Black box-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, and system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill)

6KS04 NATURAL LANGUAGE PROCESSING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Artificial Intelligence.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Natural Language Processing by being able to do each of the following:
1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To gain knowledge in Information Extraction.

Course Outcomes (Expected Outcome): On completion of the course, student will be able toï
1. Understand how to tag a given text with basic Language features
2. Design an innovative application using NLP components
3. Implement a rule-based system to tackle morphology/syntax of a language
4. Design a tag set to be used for statistical processing for real-time applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I: Overview and Morphology Hours: 6
Introduction, Models and Algorithms, Regular Expressions Basic Regular Expression Patterns, Finite State Automata, Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing

Unit II: Word Level Analysis Hours: 6
Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

Unit III: Syntactic Analysis Hours: 6
Context-Free Grammars, Grammar rules for English, Treebanks, and Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, and Probabilistic Lexicalized CFGs.

Unit IV: Semantic Analysis Hours: 6
Representing Meaning, Meaning Structure of Languages, First Order Predicate Calculus, Syntax-Driven Semantic Analysis, Semantic Attachments, Syntax-Driven Analyzer, Robust Analysis, Relations among Lexemes and their Senses, Word Sense Disambiguation

Unit V: Learning to Classify Text: Hours: 6
Supervised classification, further examples of supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.

Unit VI: Extraction Information from Text: Hours: 6
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

Text Books:
[1] Daniel Jurafsky, James H. Martin - Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
[2] Steven Bird, Ewan Klein and Edward Loper - Natural Language Processing with Python, First Edition, OReilly Media, 2009.
[3] Christopher D.Manning and Hinrich Schuetze - Foundations of Statistical Natural Language Processing, MIT press, 1999.

Reference Books:
[1] Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
[2] Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
[3] Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
[4] Roland R.Hausser - Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press,2011
[5] Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
[6] Daniel Jurafsky and James H. Martin - Speech and Language Processing, 2nd
[7] Edition , Prentice Hall,2008.
[8] Charu C.Aggarwal - Machine Learning for Text, Springer,2018 edition

6KS04 BIG DATA ANALYTICS [L-3, T-0, C-3]

Course Prerequisite: Knowledge of basic computer science principles and skills, Basic knowledge of Linear Algebra and Probability Theory, Basic knowledge of Data Base Management Systems

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Big Data Analytics by being able to do each of the following:
1. To know the fundamental concepts of big data and analytics.
2. To explore tools and practices for working with big data.
3. To know about the research that requires the integration of large amounts of data.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Work with big data tools and its analysis techniques.
2. Analyze data by utilizing clustering and classification algorithms.
3. Learn and apply different algorithms and recommendation systems for large volumes of data.
4. Perform analytics on data streams.
5. Learn NoSQL databases and management.

Unit I: Big Data Analytics and Lifecycle Hours: 6
Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics, Data Analytics Lifecycle: Overview, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize, Case Study: Global Innovation Network and Analysis (GINA).

Unit II: Review of Basic Data Analytics Methods, Clustering and Association Rules Hours: 7
Exploratory Data Analysis, Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and II Errors, ANOVA, Overview of Clustering, K-means: Use Cases, Overview, Number of Clusters, Diagnostics, Additional Algorithms, Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, The Groceries Dataset, Frequent Itemset Generation, Rule Generation and Visualization, Validation and Testing, Diagnostics.

Unit III: Regression and Classification Hours: 7
Linear Regression: Use Cases, Model Description, Diagnostics, Logistic Regression: Use Cases, Model Description, Diagnostics, Reasons to Choose and Cautions, Additional Regression Models, Decision Trees: Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees, Naïve Bayes: Bayesô Theorem, Naïve Bayes Classifier, Smoothing, Diagnostics, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods.

Unit IV: Time Series Analysis and Text Analysis Hours: 6
Overview of Time Series Analysis: Box-Jenkins Methodology, ARIMA Model: Autocorrelation Function (ACF), Autoregressive Models, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions, Additional Methods, Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequencyð Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

Unit V: Tool and Techniques: MapReduce & Hadoop Hours: 7
Big Data Tool and Techniques: Big Data Storage, High-Performance Architecture, HDFS, MapReduce and YARN, Big Data Application Ecosystem, Zookeeper, HBase, Hive, Pig, Mahout, Developing Big Data Applications: Parallelism, Myth, Application Development Framework, MapReduce Programming Model, Simple Example, More on MapReduce, Other Frameworks, The Execution Model, Analytics for Unstructured Data: Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem: Pig, Hive, HBase, Mahout, NoSQL.

Unit VI: Database Analytics, NoSQL and Graph Analytics Hours: 7
SQL Essentials, In-Database Text Analysis, Advanced SQL, NoSQL Data Management: What is NoSQL, Schema-less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph Database, Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Graph Analytics: Model, Triples, Graphs and Network Organization, Graph Analytics and Use Cases, Graph Analysis Algorithms, Technical Complexity, Features of Graph Analytic Platform, Data Visualization Basics.

Text Books:
[1] EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 2015, John Wiley & Sons, Inc., ISBN: 978-1-118-87613-8.
[2] David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", First Edition, 2013, Morgan Kaufmann/Elsevier Publishers, ISBN: 978-0-12-417319-4.

Reference Books:
[1] Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", First Edition, 2014, Wiley Publishers, ISBN: 978-1-118-89271-8.
[2] Mohammad Guller, ñBig Data Analytics with Spark A Practitionerǿs Guide to Using Spark for Large-Scale Data Processing, Machine Learning, and Graph Analytics, and High-Velocity Data Stream Processingò, First Edition, 2015, Apress Publisher, ISBN-13 (pbk): 978-1-4842-0965-3.
[3] Arshdeep Bahga & Vijay Madisetti, ñBig Data Science & Analytics: A Hands-On Approachò,
First Edition, 2019, ISBN: 978-1-949978-00-1.

6KS04 SENSORS AND ACTUATORS [L-3, T-0, C-3]

Course Prerequisite: Internet of Things, Micro-technology

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Sensors and Actuators by being able to do each of the following:
1. To understand the fundamentals of sensors and actuators
2. An exposure to sensors and its importance in the real world
3. To understand functional safety in machinery and emergency stop applications

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Fabricate some of those sensors
2. Simulate sensors and characterize before fabricating it
3. Design application with sensors and actuators for real world

Unit I: Hours: 7
Introduction: Sensors and Actuators, Technologies related to Sensors: Data Logger, Metal Detector, Photoelectric Sensor, Global Positioning System, Wireless Sensor Network, Sonar, Echo Sounding, Level Sensor, Biosensor, Blood Glucose Monitoring, Load Cell

Unit II: Hours: 7
Application of Sensors: On-board Automobile Sensors, Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Medical Diagnostic Sensors, Sensors for Environmental Monitoring

Unit III: Hours: 7
Varied Types of Actuators: Pneumatic Actuator, Hydraulic Cylinder, Linear Actuator, Plasma Actuator, Rotary Actuator

Unit IV: Hours: 7
Actuators: Technologies and Devices- Pneumatic Motor, Pneumatic Cylinder, Hydraulic Press, Jackscrew, Hoist (Device), Electroactive Polymers, Roller Screw, MEMS Magnetic Actuator.

Unit V: Hours: 7
Remote Sensing: An Overview- Water Remote Sensing, Remote Sensing, Lidar, ERDAS Imagine, TerrSet, Remote Sensing (Archaeology)

Unit VI: Hours: 7
Rader and its application: Radar, Radar Imaging, Radar Navigation

Text Books:
[1] Princeton Brown, ñSensors and Actuators: Technology and Applicationsò, Library Press, 2017.
[2] D. Patranabis, ñSENSORS AND TRANSDUCERSò, Second Edition, PHI Learning Private Limited, 2003.

Reference Books:
[1] D.A. Hall and C.E.Millar, ñSensors and Actuatorsò, CRC Press, 1999.
[2] Nathan Ida, ñSensors, Actuators, and their Interfaces: A multidisciplinary introduction (Materials, Circuits and Devices)ò, Large Print, 2011.

6KSO4 CRYPTOGRAPHY [L-3,T-0,C-3]

Course Prerequisite: Discrete Structure & Graph Theory, Data Communication and Networking, Introduction to Cyber security

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cryptography by being able to do each of the following:
1. Understand Security Concepts.
2. Know about various encryption techniques.
3. Understand the concept of public key cryptography.
4. Study about message authentication and hash functions.
5. Impart knowledge on Network security, Internet Security Protocols.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Classify the symmetric encryption techniques
2. Illustrate various public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Discuss authentication applications
5. Summarize the intrusion detection and its solutions to overcome the attacks.
6. Understand basic concepts of system level security

Unit I: Hours: 6
Attacks on Computers and Computer Security: Introduction, Need for Security, Security Approaches, Principles of Security, Types of Attacks. Cryptography: Concepts and Techniques Introduction, Plain Text and Cipher Text, Substitution and Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stenography, Key Range and Key Size, Possible Types of Attacks

Unit II: Hours: 6
Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard(DES), International Data Encryption Algorithm(IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard(AES).

Unit III: Hours:6
Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, History and Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Cryptography, Digital Signatures, Knapsack and other Algorithms.

Unit IV: Hours:6
Digital Certificates and Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML,PKI and Security, Creating Digital Certificate.

Unit V: Hours:6
Internet Security Protocols: Introduction, Concepts, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Hypertext Transport Protocol(SHTTP), Time Stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP)Security, Security in GSM, Security in 3G.

Unit VI: Hours:6
User Authentication and Kerberos: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based-Authentication, Biometric Authentication, Kerberos, Key Distribution Center(KDC), Security Handshake Pitfalls, Single Sign On (SSO) Approaches.

Text Book:

[1] Atul Kahate, ñ Cryptography and Network Securityò, McGraw Hill, Second Edition.

Reference Books:

[1] William Stallings, ñCryptography and Network Security, Principles and Practiceò, PHI Fourth Edition.
[2] Behrouz A. Forouzan and Debdeep Mukhopadhyay, ñCryptography and Network Securityò, McGraw Hill, Second Edition.
[3] Matt Bishop, ñComputer Security Arts and Scienceò, Pearson Education.
[4] Douglas R Stinson, ñCryptography, Theory and Practiceò CRC Press.
[5] Keith M Martin, ñEveryday Cryptography, Fundamental Principles and Applicationsò, Oxford University Press, Second Edition.

6KSO5 COMPUTATIONAL BIOLOGY [L-3, T-0, C-3]

Course Pre-requisite:

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:

1. To familiarize the students with most basic and useful algorithms for sequence analysis
2. To aware the students with basic file formats
3. To transform the basic molecular data for interpreting their patterns for various analysis
4. To compare genomes of different species, gene finding, and gene regulation

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.
2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems, and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

Unit I: Cellular and Molecular Biology Fundamentals Hours: 6
The structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: Sequence Alignments Hours: 6
Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequences Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: Pairwise Sequence Alignments & Database Searching Hours:6
Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, aligning complete genome sequences

Unit IV: Patterns Profiles and Multiple Alignments Hours:6
Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: Revealing Genome Features Hours:6
Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: Gene Detection and Genome Annotation Hours:6

Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:

[1] Understanding Bioinformatics , Marketa Zvelbil and Jeremy O. Baum, Garland Sceincem Taylor & Francis Group, LLC

[2] Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:

[1] Bioinformatics Algorithms ï Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.

[2] Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.

[3] Bioinformatics computing, Bergeron, B. P. (2003), Prentice Hall Professional.

[4] Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.

[5] Bioinformatics for dummies, Claverie, J. M., & Notredame, C. (2011), John Wiley & Sons.

[6] Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

6KSO5 CYBER LAWS & ETHICS [L-3,T-0,C-3]

Course Prerequisite: Basic Knowledge of Internet

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:

1. Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
2. Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
3. Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
4. Understand Criminal Liability, Cyber Crime implications and challenges.
5. Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:

1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Unit I: Hours:6

Information Technology & Cyber Crimes: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: Hours:6

Technology & Forms of Cyber Crimes: Influence of Technology on Criminality, Forms of Cyber Crimes.
Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: Hours:6

Cyber Crimes 'and Global Response: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000,
Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: Hours:6

Mens Rea & Criminal Liability: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: Hours:7

Cyber Crimes : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes :National and International Endeavours: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavours of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO),Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues

Unit VI: Hours:7

Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges. Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book:

[1] Dr Pramod Kr.Singh, ñLaws on Cyber Crimes [Along with IT Act and Relevant Rules]ò Book Enclave Jaipur India.

Reference Books:

[1] Craig B, ñCyber Law: The Law of the Internet and Information Technologyò. Pearson Education.
[2] Pawan Duggal, ñCyber Lawsò Universal Law Publishing.
[3] K.Kumar,ò Cyber Laws: Intellectual property & E Commerce, Securityò, First Edition, Dominant Publisher, 2011.
[4] Rodney D. Ryder, ñGuide to Cyber Lawsò, Second Edition, Wadhwa And Company, New Delhi, 2007.
[5] Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
[6] Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
[7] Sharma, S.R., ñDimensions of Cyber Crimeò, Annual Publications Pvt. Ltd., First Edition, 2004.
[8] Augastine, Paul T., ñCyber Crimes and Legal Issuesò, Crecent Publishing Corporation, 2007.

6KS05 INTELLECTUAL PROPERTY RIGHTS [L-3,T-0,C-3]

Course Prerequisite: Basic knowledge of Communication skills, Soft skills, Presentation and Ethics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret.
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

Unit I: Overview of Intellectual Property Rights Hours: 06

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

Unit II: Patents Hours: 08

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Unit III: Copyrights Hours: 06

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties ï Related Rights - Distinction between related rights and copyrights.

Unit IV: Trademarks Hours: 07

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Unit V: Design & Geographical Indication Hours: 07
Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Unit VI: IPR: Current Contour Hours: 06
India`s New National IP Policy, 2016 ï Govt. of India step towards promoting IPR ï Govt. Schemes in IPR ï Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:
[1] K. V. Nithyananda (2019), ñIntellectual Property Rights: Protection and Managementò, IN: Cengage Learning India Private Limited.
[2] P. Neeraj and D. Khusdeep (2014), ñIntellectual Property Rightsò, PHI learning Private Limited.

Reference Books:
[1] Deborah E. Bouchoux, ñIntellectual Property for Paralegals ï The law of Trademarks, Copyrights, Patents & Trade secretsò, 4th Edition, Cengage learning, 2012.
[2] N. S. Gopalakrishnan and T. G. Agitha, ñPrinciples of Intellectual Propertyò, Eastern Book Company, Lucknow, 2009.
[3] M. M. S. Karki, ñIntellectual Property Rights: Basic Conceptsò, Atlantic Publishers, 2009.
[4] Ganguli Prabuddha, ñIntellectual Property Rights--Unleashing the Knowledge Economyò, Tata McGrawHill, 2001.
[5] V. K. Ahuja, ñLaw relating to Intellectual Property Rightsò. India, IN: Lexis Nexis, 2017.
[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
[7] Ajit Parulekar and Sarita DôSouza, Indian Patents Law ï Legal & Business Implications; Macmillan India ltd, 2006.
[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
[9] Ganguli Prabuddha, ñGearing up for Patentsé The Indian Scenarioò, Universities Press, 1998.

6KS06 DESIGN AND ANALYSIS OF ALGORITHMS – LAB [P-2, C-1]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

[1] Implement C programs to perform recursive calls using the following searching algorithms.
   1. Linear Search when the list is given.
   2. Binary Search when the given list is not sorted.
[2] Study and analyze to sort an array of integers using merge sort.
[3] Implement and analyze to sort an array of integers using quicksort.
[4] Write a program to implement the Closest Pair of Points problem using the divide and conquer strategy.
[5] Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23, 12, 3, 5, 89, 1, 24}
[6] Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
[7] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
[8] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
[9] Implement programs to find minimum cost spanning trees from a given graph using Primôs algorithm.
[10]Implement Primôs algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
[11] Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.

[12] Implement programs to find the shortest path in a given graph using Dijkstraôs algorithm.
[13] Implement programs factorial knapsack problem.
[14] Develop a program to implement Strassenôs matrix multiplication algorithm.
[15] Implement programs to implement LCS problems using Dynamic Programming.
[16] Develop a program to implement matrix chain multiplication problems using dynamic programming.
[17] Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
[18] Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
[19] Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
[20] Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

[1] Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
[2] Design and Implement Boyer Moore Algorithm for Pattern Searching.
[3] Design and Implement Topological Sort of a graph using departure time of vertex.
[4] Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
[5] Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Books:
[1] Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education.

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KS07 SOFTWARE ENGINEERING LAB.

Course Prerequisite: A Scripting Language, IDEs (Integrated Development Environment), Databases, Software Development Life Cycle (SDLC)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. Impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner
2. Present case studies to demonstrate the practical applications of different concepts
3. Provide a scope to the students where they can solve small, real-life problems
4. All the while it is intended to present Software Engineering as an interesting subject to the students where learning and fun can go alongside.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand basic Software engineering methods and practices, and their appropriate application.
2. Describe software process models such as the waterfall and evolutionary models.
3. Discuss role of project management including planning, scheduling and, risk management.
4. Explain data models, object models, context models and behavioral models.
5. Understand of different software architectural styles and Process frame work.

List of experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

[1] Identifying the Requirements from Problem Statements
Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
[2] Estimation of Project Metrics
Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
[3] Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
Use case diagrams |,Actor , Use Case , Subject , Graphical Representation , Association between Actors and Use Cases , Use Case Relationships , Include Relationship , Extend Relationship , Generalization Relationship ,Identifying Actors , Identifying Use cases , Guidelines for drawing Use Case diagrams
[4] E-R Modeling from the Problem Statements
Entity Relationship Model , Entity Set and Relationship Set , Attributes of Entity , Keys , Weak Entity , Entity Generalization and Specialization ,Mapping Cardinalities , ER Diagram , Graphical Notations for ER Diagram , Importance of ER modeling
[5] Identifying Domain Classes from the Problem Statements
Domain Class , Traditional Techniques for Identification of Classes ,Grammatical Approach Using Nouns , Advantages , Disadvantages ,Using Generalization ,Using Subclasses , Steps to Identify Domain Classes from Problem Statement , Advanced Concepts

[6] State chart and Activity Modeling
State chart Diagrams , Building Blocks of a State chart Diagram , State , Transition , Action , Guidelines for drawing State chart Diagrams , Activity Diagrams , Components of an Activity Diagram, Activity , Flow , Decision , Merge , Fork ,Join , Note , Partition ,A Simple Example , Guidelines for drawing an Activity Diagram
[7] Modeling UML Class Diagrams and Sequence diagrams
Structural and Behavioral aspects , Class diagram , Elements in class diagram , Class , Relationships , Sequence diagram , Elements in sequence diagram , Object , Life-line bar , Messages
[8] Modeling Data Flow Diagrams
Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD , Context diagram and leveling DFD
[9] Estimation of Test Coverage Metrics and Structural Complexity
Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits , Demerits
[10] Designing Test Suites
Software Testing , Standards for Software Test Documentation , Testing Frameworks , Need for Software Testing , Test Cases and Test Suite , Types of Software Testing , Unit Testing , Integration Testing , System Testing , Example , Some Remarks.

Software Requirements: StarUML

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill).

6KS09 C SKILL LAB IV– LAB (DevOps) [P-2, C-1]

Course Prerequisite: Basic knowledge on SDLC and STLC

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of DevOps learning by being able to do each of the following:
1. Learn what Jenkins, continuous integration is and where does Jenkins fits into SDLC (Software Development Life Cycle)
2. Learn how to setup Jenkins and use Jenkins on their systems, create and configure jobs in Jenkins
3. Learn how to use and manage plugins, how to create and manage users in Jenkins
4. Learn how to deploy application on server, how to work with multiple nodes
5. Learn how to create pipelines

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Install and setup of Jenkins on your systems
2. Create and run jobs in Jenkins
3. Add and manage plugins. Use plugins in jobs
4. Create and run pipelines in Jenkins
5. Setup, configure, and deploy jobs

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)
List of Experiments based on Syllabus: (Maximum 20)

1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle
4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

List of Experiments beyond Syllabus: (Maximum 05)

1. Learn how to setup Jenkins on docker
2. Learn how to do Jenkins maintenance
3. Learn how to work with Git and Jenkins

Text Book: John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

Reference Books:
[1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
[2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
[3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress

6KS08 EMERGING TECHNOLOGY LAB II

6KS08 Emerging Technology Lab II is based on 6KS04 Professional Elective-II. Tentative FOSS Tools & Technology for Practicalôs are as follows:

AI : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob

DS : KNIME, Spark, Neo4J, MongoDB, Hive, Storm,

IoT : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring

Cyber Security : VeraCrypt, ModSecurity, AdBlocker, CheckShortURL, SPAMfighter, SpamBully

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B.E. COMPUTER ENGINEERING (SEM. V& VI)

SYLLABUS OF B.E. SEM. V (COMPUTER ENGINEERING)

5KE01 DATABASES [L-4, T-0, C-4]

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Databases by being able to do each of the following:

1. To understand the fundamental concepts of database management system.
2. To learn database query languages.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To understand the query processing and optimization.
5. To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS **Hours: 8**
Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features

Unit II: Relational Algebra, SQL **Hours: 8**
Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra,Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the DatabaseOperations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database,Join expressions, Views

Unit III: Relational Database Design **Hours: 8**
Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multivalued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization **Hours: 8**
Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management **Hours:8**
Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system **Hours:8**
Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multiversion schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage, early lock release and logical undo operations, , Remote Backup Systems

Text Book: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill.

Reference Books:
1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaumôs Outlines)

5KE02 COMPILERS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compilers by being able to do each of the following:
1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3. To study concept of syntax directed definition and translation scheme for the representation of language
4. To illustrate the various optimization techniques for designing various optimizing compilers.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiler **Hours: 06**
Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA.

Unit II: Syntax Analysis **Hours: 07**
Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing **Hours: 07**
Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation **Hours: 07**
Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDDôs: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation **Hours: 07**
Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), Three Address Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation **Hours:06**
Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education Second Edition.

Reference Books:
1. D. M. Dhamdhere, Compiler Constructionð Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
4. K C. Louden ñCompiler Constructionð Principles and Practiceò India Edition, CENGAGE.
5. Bennett J.P., ñIntroduction to Compiling Techniquesò, 2/e (TMH).

5KE03 COMPUTER ORGANIZATION & ARCHITECTURE [L-3, T-0, C-3]

Course Pre-requisite:
Microprocessor & Assembly Language Programming.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Organization & Architecture by being able to do each of the following:

1. To discuss the basic concepts and structure of computers.
2. To solve concepts of arithmetic operations.
3. To understand addressing modes and memory organization.
4. To analyze conceptualize multitasking ability of a computer and pipelining
5. To explain IO communication.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer **Hours: 7**
Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.

Unit II: Memory Unit **Hours: 7**
Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit **Hours: 8**
Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization **Hours:6**
Accessing I/O Devices, Interrupts, Enabling and Disabling Inerrupts, Handling Multiple Devices, DMA,I/O Hardware, Standard I/O Interfaces:SCSI.

Unit V: Arithmetic **Hours: 7**
Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers ,Booth Multiplier, Fast Multiplication ,Integer Division, Floating Point Numbers and Operations.

Unit VI:Parallel Organization and Pipelining **Hours: 7**
Parallel Processing, Array Processors, The Structure of General Purpose Multiple Processors, Symmetric, Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Memory Organization in Multiprocessors. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards

Text Book: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, ñComputer Organizationò, Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, ñComputer Organization and Architecture: Designing for Performanceò, Eighth Edition, Pearson.
2. John P. Hayes, ñComputer Architecture and Organizationò, McGraw Hill Publication.
3. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
4. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

5KE04 COGNITIVE TECHNOLOGIES [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Artificial Intelligence, Programming and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cognitive Technologies by being able to do each of the following:

1. This course intends to introduce concept of cognitive technologies and important approaches of cognitive technologies.
2. Student will learn and analyze key concept of cognitive technologies.
3. Students will gain an understanding of innovation concepts, terminology, current and future trends in cognitive technologies.
4. Introduces students to IBM Watson platform, an artificially intelligent computer system capable of answering questions posed in natural language, developed in IBMôs Deep QA project.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the Cognitive computing and principles of cognitive systems.
2. Identify role of Natural Language Processing in cognitive system.
3. Outline application of advanced analytics in cognitive computing.
4. Justify role of Cloud and Distributed Computing in Cognitive Computing.
5. Assess the process of building a Cognitive Application.
6. Identify the Emerging Areas and Future Applications of Cognitive Computing.

Unit I: Foundation of Cognitive Computing & Design Principle of Cognitive Systems Hours: 07

The Foundation of Cognitive Computing: Cognitive Computing as a New Generation, The Uses of Cognitive Systems, What Makes a System Cognitive, Gaining Insights from Data, Domains Where Cognitive Computing Is Well Suited, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, Two Systems of Judgment and Choice, Understanding Complex Relationships Between Systems, The Elements of a Cognitive System, Infrastructure and Deployment Modalities.Design Principles for Cognitive Systems: Components of a Cognitive System, Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.

Unit II: NLP and Big Data in Cognitive System Hours: 07

Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems. The Relationship between Big Data and Cognitive Computing: Dealing with Human-Generated Data, Defining Big Data, the Architectural Foundation for Big Data, Analytical Data Warehouses, Hadoop, Data in Motion and Streaming Data, Integration of Big Data with Traditional Data.

Unit III: Knowledge Representation and Advance Analytics in Cognitive Computing Hours: 06

Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Developing a Cognitive System, Defining Taxonomies and Ontologies, Explaining How to Represent Knowledge, Models for Knowledge Representation. Applying Advanced Analytics to Cognitive Computing: Advanced Analytics Is on a Path to Cognitive Computing, Key Capabilities in Advanced Analytics, Using Advanced Analytics to Create Value, Impact of Open Source Tools on Advanced Analytics.

Unit IV: Role of Cloud and Distributed Computing in Cognitive Computing Hours: 07

The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Why Cloud Services Are Fundamental to Cognitive Computing Systems, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Data Integration and Management in the Cloud. The Business Implications of Cognitive Computing: Preparing for Change, Advantages of New Disruptive Models, What Does Knowledge Mean to the Business?, The Difference with a Cognitive Systems Approach, Meshing Data Together Differently, Using Business Knowledge to Plan for the Future, Answering Business Questions in New Ways, Building Business Specific Solutions, Making Cognitive Computing a Reality, How a Cognitive Application Can Change a Market.

Unit V: Cognitive System: IBM Watson and Process of Building a Cognitive Application Hours: 07
IBMôs Watson as a Cognitive System: Watson Defined, Advancing Research with a ñGrand Challengeò, Preparing Watson for Jeopardy, Preparing Watson for Commercial Applications, The Components of DeepQA Architecture. The Process of Building a Cognitive Application: The Emerging Cognitive Platform, Defining the Objective, Defining the Domain, Understanding the Intended Users and Defining their Attributes, Defining Questions and Exploring Insights, Creating and Refining the Corpora, Training and Testing. Building a Cognitive Healthcare Application: Foundations of Cognitive Computing for Healthcare, Constituents in the Healthcare Ecosystem, Learning from Patterns in Healthcare Data, Building on a Foundation of Big Data Analytics, Cognitive Applications across the Healthcare Ecosystem, Starting with a Cognitive Application for Healthcare, Using Cognitive Applications to Improve Health and Wellness, to Enhance the Electronic Medical Record and to Improve Clinical Teaching.

Unit VI:Emerging Areas and Future Application Hours: 06
Smarter Cities: Cognitive Computing in Government: How Cities Have Operated, The Characteristics of a Smart City, The Rise of the Open Data Movement Will Fuel Cognitive Cities, The Internet of Everything and Smarter Cities, Understanding the Ownership and Value of Data, Smarter Approaches to Preventative Healthcare, Building a Smarter Transportation Infrastructure, Using Analytics to Close the Workforce Skills Gap, Creating a Cognitive Community Infrastructure, The Next Phase of Cognitive Cities. Emerging Cognitive Computing Areas: Characteristics of Ideal Markets for Cognitive, Computing Vertical Markets and Industries. Future Applications for Cognitive Computing: Requirements for the Next Generation, Technical Advancements That Will Change the Future of Cognitive Computing, What the Future Will Look Like, Emerging Innovations.

Text Book: Judith Hurwitz, Marcia Kaufman and Adrian Bowles, "Cognitive Computing and Big Data Analytics", publication John Wiley & Sons, Inc, 2015.

Reference Books:
[1] José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, publication Cambridge University Press, New York, Second Edition.
[2] Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, Inc. London, 2014.
[3] Huimin Lu (Editor), Cognitive Internet of Things: Frameworks, Tools and Applications, Springer Nature Switzerland AG 2020.
[4] Danish Contractor and Aaditya Telang (Editors), Applications of Cognitive Computing Systems and IBM Watson, 8th IBM Collaborative Academia Research Exchange, publication Springer Nature Singapore Pte Ltd., 2017.
[5] S. Bird, E. Klein, E. Loper (2009), Natural Language Processing with Python, OôReilly Media.

5KE04 ADVANCE COMPUTER ARCHITECTURE [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Computer Organization

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Advance Computer Architecture by being able to do each of the following:
1. Understand the concept of Parallel Processing
2. To impart the concepts and principles of parallel and advanced computer architectures
3. To develop the design techniques of Scalable and multithreaded Architectures.
4. To apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe Computational models and Computer Architectures.
2. Discuss Concepts of parallel computer models
3. Explain Scalable Architectures, Pipelining, Superscalar processors, multiprocessors
4. Distinguish the performance of pipelining and non-pipelining environment in a processor.

Unit I: Parallel Computing Models Hours: 6
Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

Unit II: Principals of Scalable performance Hours: 6
Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches.

Unit III: Hardware Technologies Hours: 6

Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology, Bus Cache and Shared memory, Backplane bus systems, Cache Memory organizations, Shared Memory Organizations, Sequential and weak consistency models.

Unit IV: Pipelining **Hours: 6**
Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors,Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

Unit V: Parallel and Scalable Architectures **Hours: 6**
Multiprocessors and Multicomputers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputers, Message-passing Mechanisms, Multivetor and SIMD computers, Vector Processing Principals, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organization, CM-2 Architecture.

Unit VI: Scalable, Multithreaded and Dataflow Architectures **Hours: 6**
Latency-hiding techniques, Principals of Multithreading, Fine-Grain Multicomputers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures

Text Book: Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.

Reference Books:
1. Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER
2. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education
3. Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
4. Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor & Francis.

5KE04 INTERNET OF THINGS [L-3, T-0, C-3]

Course Pre-requisite: Basic knowledge of Internet and Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Internet of Things by being able to do each of the following:
1. To learn and understand fundamental of IoT
2. To study the design methodology and different IoT platform
3. To understand usefulness of IoT for society
4. To design and implement application of IoT using various sensor

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:
1. Understand the basics of IoT
2. Understand design methodology and platforms involved in IoT
3. Apply the knowledge to interface various sensors with IoT development
4. Design and Implement IoT system for real time application.

Unit I: **Hours: 6**
Introduction to Internet of Things, Definition & Characteristics of IoT, Physical Design of IoT Logical Design of IoT, IoT Enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels & Deployment Templates, Domain Specific IoTs: Home, Cities, Environment, Energy systems, Logistics, Agriculture, Health & Lifestyle .

Unit II: **Hours: 7**
IOT & M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software defined networks, network function virtualization, IoT Systems Management, Simple Network Management Protocol (SNMP) ,Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG, NETOPEER.

Unit III: **Hours: 7**
IoT Platforms Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, IoT Systems - Logical Design using Python ,Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling l, Date/Time Operations, Classes, Python Packages of Interest for IoT.

Unit IV: **Hours: 7**

IoT Physical Devices & Endpoints, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces serial, SPI, I2C, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and switch with Raspberry Pi, Interfacing Light Sensor with Raspberry Pi Other IoT Devices, pcDuino, BeagleBone Black, Cubieboard.

Unit V: **Hours: 7**

IoT Physical Servers & Cloud Offerings, Introduction to Cloud Storage Models & Communication APIs , WAMP - AutoBahn for IoT , Xively Cloud for IoT , Python Web Application Framework - Django , Designing a RESTful Web API , Amazon Web Services for ,SkyNet IoT Messaging Platform.

Unit VI: **Hours: 7**
Case Studies Illustrating IoT Design, Introduction, Home Automation: Smart Lighting, Home Intrusion detection, Cities: Smart parking, Environment: Weather Monitoring System, Weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture: Smart Irrigation, Productivity Applications: IoT printer.

Text Book: Arshdeep Bahga, Vijay Madisetti, ñInternet of Things ï A hands-on approachò, Universities Press, ISBN:0: 0996025510, 13: 978-0996025515.

Reference Books:
1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012.
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ñFrom Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligenceò, 1st Edition, Academic Press, 2014

5KE04 GRAPHICS & VISUALIZATION [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Multimedia

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Graphics & Visualization by being able to do each of the following:
1. Explain hardware, software and OpenGL Graphics Primitives.
2. Illustrate interactive computer graphic using the OpenGL.
3. Design and implementation of algorithms for 2D graphics Primitives and attributes.
4. Demonstrate Geometric transformations, viewing on both 2D and 3D objects.
5. Infer the representation of curves, surfaces, Color and Illumination models.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Explain fundamental concepts within computer graphics
2. Understand the ideas in some fundamental algorithms for computer graphics and to some extent be able to compare and evaluate them
3. Apply fundamental principles within interaction programming
4. Understand fundamental concepts within information visualization and scientific visualization

Unit I: Introduction **Hours: 06**
Brief History, Applications, Concepts, Graphics Pipeline, Image Buffers , Graphics Hardware , Conventions

Unit II: Rasterization Algorithms **Hours: 07**
Introduction ,Mathematical Curves and Finite Differences, Line Rasterization, Circle Rasterization, Point-in-Polygon Tests , Polygon Rasterization , Perspective Correction ,Spatial Antialiasing , Two-Dimensional Clipping Algorithms

Unit III: 2D and 3D Coordinate Systems and Transformations **Hours: 07**
Introduction , Affine Transformations , 2D Affine Transformations , Composite Transformations, 2D Homogeneous Affine Transformations ,2D Transformation Examples, 3D Homogeneous Affine Transformations , 3D Transformation Examples , Quaternions, Geometric Properties

Unit IV: Projections and Viewing Transformations **Hours: 07**
Introduction, Projections, Projection Examples, Viewing Transformation, Extended Viewing Transformation, Frustum Culling and the Viewing Transformation, The Viewport Transformation.

Unit V: Subdivision for Graphics and Visualization **Hours: 07**
Introduction, Notation , Subdivision Curves , Subdivision Surfaces , Manipulation of Subdivision Surfaces , Analysis of Subdivision Surfaces, Subdivision Finite Elements

Unit VI: Visualization Principles **Hours: 06**

Introduction, Methods of Scientific Exploration, Data Aspects and Transformations, Time-Tested Principles for Good Visual Plots, Tone Mapping, Matters of Perception, Visualizing Multidimensional Data.

Text Book: T. Theoharis G. Papaioannou N. Platis N. Patrikalakis Graphics and Visualization: Principles & Algorithms.

Reference Books:
1. Edward Angel, Interactive Computer Graphics, A Top-Down Approach Using OpenGL Pearson 2008 fifth Edition
2. Donald Hearn and Pauline Baker and F. S. Hill Jr. and S. M. Kelley ,Computer Graphics with OpenGL Prentice Hall 2003 & 2006,third edition

5KE05 PRINCIPLES OF MARKETING FOR ENGINEERING

L-3, T-0, C-3

Course Prerequisite: Basic knowledge of Computers

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Principles of Marketing for Engineering by being able to do each of the following:

1. To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success;
2. To develop a digital marketing plan; to make SWOT analysis;
3. To define a target group; to introduced to various digital channels, their advantages and ways of integration;
4. To integrate different digital media and create marketing content to manage a digital marketing performance efficiently.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Identify the importance of the digital marketing for marketing success,
2. Manage customer relationships across all digital channels and build better customer relationships,
3. Create a digital marketing plan, starting from the SWOT analysis and defining a target group,
4. Identify digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget

Unit I: Introduction to e-Marketing: **Hours: 7**

Introduction, Wired-up world, B2C, B2B, C2B and C2C Model, Objectives: Sell, Serve, Speak, Save, Sizzle, Introduction to e-strategy

Unit II: Remix and e-Models **Hours: 7**

Introduction to Remix: Product, Price, Place, Promotion, People, Process. Introduction to e-Models, e-Marketplace, Digital Communication market, Web & Social Network Models, Customer buying models, Loyalty models

Unit III: e-Customers **Hours: 7**

Introduction to e-Customers, Motivations, Expectations, Fears & Phobias, Online Buying Process, information processing, relationship & royalty, Communities & social networks, Customer profiles

Unit IV: e-Tools & Site Design **Hours:7**

Introduction to e-Tools, Technology development & customer impact, Interactive digital TV, Digital Radio, Mobile Devices, Interactive self-service kiosks, Convergence, Integrated Campaigns, Web-site design, Integrated design, online value proposition, Dynamic & aesthetics design

Unit V: Traffic Building **Hours: 7**

Search Engine Marketing, Online PR & Partnerships, Interactive Advertising, e-mail & viral marketing, Online traffic building, Control, Resourcing

Unit VI: e-CRM & e-Business **Hours: 7**

Introduction to e-CRM, Database marketing, e-CRM, Profiling, Personalization, Introduction to e-Business, e-Business Architecture & framework, e-business security.

Text Book: E-Marketing excellence: Planning & Optimizing your Digital Marketing, Dave Chaffey & P R Smith, 3rd Edition, Butterworth-Heinemann, Elsevier.

Reference Books:

1. Marketing 4.0: Moving from Traditional to Digital, Philip Kotler, H. Kartajaya, I. Setiawan, Wiley.
2. Business Marketing and Management Principles for IT and Engineering, D. N. Chorafas, CRC Press.
3. Marketing Management, Philip Kotler, Kevin Keller, 12th Edition, Pearson Prentice Hall.
4. Marketing Insights from A to Z, Philip Kotler, John Wiley & Sons..

5KE05 FUNDAMENTALS OF FINANCE & ACCOUNTING

(L-3, T-0, C-3)

Course Prerequisite: Basic Knowledge of Mathematics

Objectives: Throughout the course, students will be expected to demonstrate their understanding of Fundamentals of Finance & Accounting by being able to do each of the following:

1. Know and apply accounting and finance theory
2. Critically evaluate financial statement information
3. Evaluate and compare different investments.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Define bookkeeping and accounting
2. Explain the general purposes and functions of accounting
3. Explain the differences between management and financial accounting
4. Describe the main elements of financial accounting information ï assets, liabilities, revenue and expenses
5. Identify the main financial statements and their purposes.

Unit I: The basics of Accounting I **Hours: 7**
The Assets, Liabilities and Balance Sheets, Procedure for creating a Balance Sheet, Different forms of Balance Sheet, Basic concepts of Accounting

Unit II: The basics of Accounting II **Hours: 7**
The Profit & Loss Account, Cash Flow Statement, Creating Profit & Loss Account, Creating Cash Flow Statement, Book Keeping Basic terminology, Debt & Credit Convention

Unit III: Interpretation of Accounts **Hours: 8**
Accounting Rules, Reports, Assets, Liabilities, ShareholdersôEquity, P&L Statement,

Unit IV: Introduction to Financial Management **Hours: 6**
What is Finance, Forms of Business Organization, Stock Price & Shareholder Value, Intrinsic Value, Stock Price, Business trends and ethics, Conflicts management.

Unit V: Financial Markets and Institutions **Hours: 7**
Financial Markets, Capital Allocation, Financial Institutions, Stock Market, Market for Common Stock, Stock Market Returns, Stock Market Efficiency

Unit VI: Financial Statements & Analysis **Hours: 7**
Financial Statements & Reports, Stockholdersô Equity, Free Cash Flow, Income Taxes, Analysis of Financial Statements: Ratio Analysis, Liquidity Ratios, Asset & Debt Management Ratio, Profitability Ratio, Trend Analysis.

Text Books:
1. Accounts Demystified, 5th Edition, Anthony Rice, Pearson ï Prentice Hall
2. Fundamentals of Financial Management, 6th Edition, E. F. Brigham, J.F. Houston, Cengage Learning.

Reference Books:
1. Engineering Economics: Financial Decision Making for Engineering, N. M. Fraser, E. M. Jewkes, 5th Edition, Pearson Publication.
2. Financial Fundamentals for Engineers, Richard Hill & George Slot, Butterworth-Heinemann, Elsevier.
3. Financial Accounting, Jerry Weygandt, Paul Kimmel, Donald Kieso, 9th Edition, Wiley
4. Financial Accounting: Tools for Business Decision Making, Jerry Weygandt, Paul Kimmel, Donald Kieso, 6th Edition, Wiley Plus.

5KE05 ENTREPRENEURSHIP

L-3,T-0,C-3

Course Prerequisite: Basic Knowledge of Business, Management Techniques.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Entrepreneurship by being able to do each of the following:
1. Understand basic concepts in the area of entrepreneurship
2. Understand the role and importance of entrepreneurship for economic development
3. Develop personal creativity and entrepreneurial initiative,
4. Adopt the key steps in the elaboration of business idea.

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:
1. Analyze the business environment in order to identify business opportunities,
2. Identify the elements of success of entrepreneurial ventures,
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Specify the basic performance indicators of entrepreneurial activity,
5. Explain the importance of marketing and management in small businesses venture,
6. Interpret their own business plan.

Unit I: **Hours: 6**
Introduction to Entrepreneurship: Introduction, Common Myths About Entrepreneurs, Types of Start- Up Firms, Changing Demographics of Entrepreneurs, Entrepreneurship Importance. Recognizing Opportunities and Generating Ideas: Identifying and Recognizing Opportunities, Finding Gaps in the Marketplace, Techniques for Generating Ideas, Encouraging and Protecting New Ideas.

Unit II: **Hours: 6**
Feasibility Analysis: Product/Service Feasibility Analysis, Industry/Target Market Feasibility Analysis, Organizational Feasibility Analysis and Financial Feasibility Analysis. Writing A Business Plan: The Business Plan, Outline of the Business Plan, Presenting the Business Plan to Investors.

Unit III: **Hours: 6**
Industry and Competitor Analysis: Industry Analysis, Industry Trends, The Five Competitive Forces Model, The Value of the Five Forces Model, Industry Types and the Opportunities, Competitor Analysis, Identifying Competitors, Sources of Competitive Intelligence, Completing a Competitive Analysis Grid. Developing an Effective Business Model: Business Models, Components of an Effective Business Model.

Unit IV: **Hours: 6**

Ethical and Legal Foundation: Initial Ethical and Legal issues facing a New Firm, Drafting a Founders Agreement, Avoiding Legal Disputes, Business Licenses and Permits, Choosing a Form of Business Organization. Assessing A New Ventureøs Financial Strength and Viability: Introduction to Financial Management, Financial Statements and Forecasts, Pro forma Financial Statements.

Unit V: **Hours: 6**

New Venture Team: Creating a New-Venture Team, Rounding out the Team: The Role of Professional Advisers. Getting Financing or Funding: The Importance of Getting Financing or Funding, Sources of Equity Funding, Sources of DEBT Financing, Creative Sources of Financing and Funding.

Unit VI **Hours: 6**

Unique Marketing Issues: Selecting a Market and Establishing a Position, Key Marketing issues for New Ventures, The 4Ps of Marketing for New Ventures. The Importance of Intellectual Property: The Importance of Intellectual Property, Patents, Trademarks, Copyrights, Trade Secrets, Conducting an Intellectual Property Audit.

Text Book: Bruce R. Barringer, R. Duane Ireland, ñEntrepreneurship Successfully Launching New Venturesò, Pearson Education, Third Edition.

Reference Books:

1. Ram Chandran, ñEntrepreneurial Developmentò, Tata McGraw Hill, New Delhi
2. Khanka, S S. ñEntrepreneurial Developmentò, S Chand & Company Ltd. New Delhi
3. Badhai, B ñEntrepreneurship for Engineersò, Dhanpat Rai & Co. (p) Ltd.
4. Gupta and Srinivasan, ñEntrepreneurial Developmentò, S Chand & Sons, New Delhi.
5. Arya Kumar, Entrepreneurship, Pearson, Delhi
6. Poornima MCH, Entrepreneurship Development ï Small Business Enterprises, Pearson, Delhi
7. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
8. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi

5KE06 DATABASES - LAB

P-2, C-1

Course Prerequisite: Basic concept of programming, basic concepts of data structures.

Course Objectives:

1. To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
2. To study the primary data model (relational model) for commercial data processing applications.
3. To study the standard structured query language and retrieve the information from the database in various ways.
4. To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome) : On completion of the course, the students will be able to

1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

Practical 1: To Study a Database Modeling Tool.

Study of Data Modeling Tools

- Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
- Logical / Physical Modeling
- Adding an entity / its attributes , relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
- Forward / reverse engineering
- Details of forward engineering / schema generation
- Steps to generate the schema

Practical 2: To Study and implement DDL Commands

Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.

- Creating the proper tables
- Insert the data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I

- SQL queries : Write and execute different SQL queries
- Execute Simple queries using SELECT, FROM, WHERE clauses,
- In Where clause use different predicates involving OR,AND, NOT
- Rename operation
- Tuple Variables
- Write SQL for various String operations (%,_,*)
- Match beginning with
- Match ending with
- Substring
- Match exactly n characters
- Match at least n characters
- Sort the output of the query using Order by
- Write SQL using Having

Practical 4 : To Study and implement DML Commands-II
Write SQL queries and perform

- Set membership operations
- In, not in
- Some
- All
- Exists and not exists, Test for emptyness using exists, not exists
- Test for absence of duplicates.
- Nested queries

Practical 5: Study and implement aggregation functions.
Write different queries using following Aggregate functions

- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.

Practical 7: Write SQL to perform the modifications to the database

Practical 8 : PL /SQL

Practical 9 : Database Access Using Cursors

Write a trigger to find the names and cities of customers who have more than xyz in any account.

Practical 10 : Triggers

- Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Write a trigger for dealing with blank cities (set the city field to null when it is blank)
- 11. Practical 11: Procedures, functions
- Write atleast 2 functions, and demonstrate its use
- Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)
HTTP, A Simple Example., Printing HTML Tables., Passing Parameters., Processing HTML Forms., Multi-Valued Parameters.

Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)

Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents Beyond Syllabus) A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.

Practical 15: PHP : Develop a simple application to access the database using PHP (Contents Beyond Syllabus)

Practical 16: Study of Open Source NoSQL Databases

Practical 16: Based on the concepts covered in text create a Mini Project:

Suggested Topics :

1. Bank database (Given in Korth book)
2. University Database (Given in Korth book)
3. Airline Flight Information System.
4. Library Database Application.
5. University Student Database.
6. Video Chain Database.
7. Banking Database.
8. BiBTeX Database.
9. Music Store Database.
10. Online Auctions Database.
11. A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books: (may be 5 to 6)
1. Kevin Roebuck, ñStoring and Managing Big Data - NoSQL, HADOOP and Moreò, Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, ñMangoDB: The Definitive Guideò, O‟Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, ñNoSQL For Dummiesò, John Wiley & Sons, ISBN-1118905628
4. C J Date, ñAn Introduction to Database Systemsò, Addison-Wesley, ISBN: 0201144719

5KE07 COMPILERS - LAB

P-2, C-1

Course Prerequisite: Basic knowledge of C Programming, Data Structures, Theory of Computation.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:
Know the basic components of a Compiler.
1. To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool.
2. To implement various parsing methods.
3. To implement code optimization techniques.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Identify the fundamentals of compiler and its phases.
2. Use the powerful compiler generation tools such as Lex and Yacc.
3. Write a lexical scanner, either from scratch or using Lex.
4. Develop program for solving parser problems.
5. Examine the various optimization techniques.

List of Experiments:
This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Implement a C program to check parenthesis of regular expression is balanced or not.
4. Implement a C program to construct NFA from regular expression.
5. Implement a C program to simulate Deterministic Finite Automation (DFA) for a string which ending with óaô, óa*b+ô, óabbô
6. Write a C program to construct of DFA from NFA.
7. Implement a Lex program to verify the parenthesis of a given expression is balanced.
8. Implement a Lex program to recognize the token like Digit, Identifier & Delimiter.
9. Implement the Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
10. Implement a Lex program to a valid arithmetic expression and to recognize the identifier and operators present.
11. Implement a Lex program to count words, characters, lines, vowels and consonants from given input.
12. Implement a Lex program to check given number is positive negative or zero.
13. Implement a Lex program to generate string which is ending with zeros.
14. Implement LEX and Yacc tool to implement desk calculator.
15. Write a C program for constructing of SLR parsing.
16. Write a C program for constructing of LL (1) parsing.
17. Write a C program for constructing of LALR parsing.
18. Write a C program for constructing recursive descent parsing.
19. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
20. Write a C program for Tokenizing the file which reads a source code in C/C++ from an unformatted file and extract various types of tokens from it
21. Write functions to find FIRST and FOLLOW of all the variables / given grammar.
22. Implement a Shift Reduce Parser for the following productions.
23. E Ÿ E+E / E*E / a / b
24. Implement a symbol table containing functions create(), modify(), search(), display() and delete().
25. Implement three address Code for the input a=b*c.
26. Implement Recursive Decent Parser for the productions.

List of Experiments beyond Syllabus: (Maximum 05)
1. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
2. Write a C program to generate machine code from abstract syntax tree generated by the parser.
3. Write a Lex program to find out total number of vowels, and consonants from the given input string.
4. Implementation of Finite State machines DFA, NFAs.
5. Computation of Leading & Trailing Sets.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education, Second Edition.

Reference Books:

1. Doug Brown, John Levine, and Tony Mason, ñLex & Yaccò, OôReilly & Associates, Inc., Second Edition.
2. Andrew Appel, ñModern Compiler Implementation in Cò, Cambridge University press.
3. K C. Louden ñCompiler Construction - Principles and Practiceò India Edition, CENGAGE.
4. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs and Koen Langendoen, ñModern Compiler Designò, Second Edition, John Wiley & Sons Publication.
5. Keith Cooper and Linda Torczon, ñEngineering: A Compilerò, Second Edition, Morgan Kaufmann .Publication.

5KE09 C-SKILL LAB – III [P-2, C-1]

Course Prerequisite: Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

1. To develop an ability to set up a local JS Library/Framework development Environment.
2. To be able to install and implement different JS Libraries and Frameworks
3. To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments:

This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the ñupper-caseò package of NPM.
7. EventEmitter object.
8. To study and implement the Formidable module of Node.js to upload the file on the server.
9. To study and implement the Nodemailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using ñINSERTò statement and Node.js
13. To demonstrate the display of records from the MySQL database using ñSELECTò statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using ñWHEREò statement using Node.js
15. To demonstrate deletion of records from database using ñDELETEò statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

1. Create an Email sender app using Node.js
2. Create an Basic User database: Site in which User can Sign up/Login and can see other Userôs Profile Information.
3. Create a User model covering Registration, Email verification(send an email), login (with remember me, display user details and allow to save/update user details(DOB, Location, Hobbies etc or anything)
4. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, OôReilly.

Reference Books:

1. ShyamSeshadri: Angular Up and Running, O'Reilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, O'Reilly

5KE08 DEPARTMENT PROFESSIONAL ELECTIVE-I LAB

5KE08 Department Professional Elective-I Lab is based on 5KE04 Professional Elective-I. Tentative FOSS Tools & Technology for Practical's are as follows:
AI: IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph
Cloud: Stackato, Docker, Salt Stack, OpenQRM-Openshift
IoT: Arduino, DeviceHive, Kaa, Home Assistant
Multimedia: LibreOffice Draw, Lumen5, Openshot

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B.E. (COMPUTER ENGINEERING) SEMESTER – VI

Syllabus of B.E. Sem. VI (Computer Engineering)

6KE01 SOFTWARE ENGINEERING

L-3, T-0, C-3

Course Prerequisite: Fundamentals of Programming Languages
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.
6. To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome):
On completion of the course, student will be able to–
1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

Unit I: Introduction to Software Engineering **Hours: 6**

Software Process Models Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping ,RAD ,Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice .

Unit II: Project Management: **Hours: 6**
Process, Metrics, Estimations & Risks ,Measures, Metrics & Indicators. Metrics in process & project domains- software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling & Quality Management **Hours: 06**
Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering **Hours:06**
System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design **Hours: 06**
Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing **Hours: 06**
Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

6KE02 ALGORITHMIC

[L-4, T-0, C-4]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Algorithmics by being able to do each of the following:

1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue **Hours: 8**
Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion

Unit II: Divide And Conquer **Hours: 8**
Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.

Unit III: Greedy Methods **Hours: 8**
Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Primôs Algorithms, Kruskalôs Algorithm, Dijkstras Shortest Path Algorithm.

Unit IV: Dynamic Programming **Hours: 8**
Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.

Unit V: Backtracking **Hours: 8**
Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.

Unit VI: Efficiency of Algorithm **Hours: 8**
Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education .

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KE03 SIGNALS AND SYSTEMS

[L-3, T-0, C-3]

Course Prerequisite: Communication Engineering

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Signal and System by being able to do each of the following:
1. To understand the basic properties of signal and systems
2. To know the methods of characterization of LTI systems in time domain
3. To analyze continuous time signals and system in the Fourier and Laplace domain
4. To analyze discrete time signals and system in the Fourier and Z transform domain

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Represent and Classify signal and systems.
2. Obtain the response of a continuous, linear, time-invariant, causal system by using convolution.
3. Utilize the Laplace transform method to solve continuous, linear, time-invariant systems and to obtain transfer functions.
4. Analyse continuous, linear time-invariant systems using state variable formulation and solve the resulting state equations.
5. Convert a continuous-time signal to the discrete-time domain and reconstruct it using the sampling theorem.

Unit I: **Hours: 7**
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals ï Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals.

Unit II: **Hours: 7**
Classification of systems- CT systems and DT systems- ï Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

Unit III: **Hours: 7**
Fourier series for periodic signals ï Fourier Transform ï properties- Laplace Transforms and properties.

Unit IV: **Hours: 7**
Impulse response ï convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems ï Systems connected in series / parallel.

Unit V: **Hours: 7**
Baseband signal Sampling ï Fourier Transform of discrete time signals (DTFT) ï Properties of DTFT ï Z Transform & Properties.

Unit VI: **Hours: 7**
Impulse response ï Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

Text Book: Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson, 2015.

Reference Books:
1. B. P. Lathi, Principles of Linear Systems and Signals, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, Signals and Systems ï Continuous and Discrete, Pearson, 2007.
3. John Alan Stuller, An Introduction to Signals and Systems, Thomson, 2007.

6KE04 NATURAL LANGUAGE PROCESSING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Artificial Intelligence.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Natural Language Processing by being able to do each of the following:
1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To gain knowledge in Information Extraction.

Course Outcomes (Expected Outcome): On completion of the course, student will be able toï
1. Understand how to tag a given text with basic Language features
2. Design an innovative application using NLP components
3. Implement a rule-based system to tackle morphology/syntax of a language
4. Design a tag set to be used for statistical processing for real-time applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I: Overview and Morphology **Hours: 06**
Introduction, Models and Algorithms, Regular Expressions Basic Regular Expression Patterns, Finite State Automata, Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing.

Unit II: Word Level Analysis **Hours:06**
Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

Unit III: Syntactic Analysis **Hours: 06**
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, Probabilistic Lexicalized CFGs.

Unit IV: Semantic Analysis **Hours:06**
Representing Meaning, Meaning Structure of Languages, First Order Predicate Calculus, Syntax-Driven Semantic Analysis, Semantic Attachments, Syntax-Driven Analyzer, Robust Analysis, Relations among Lexemes and their Senses, Word Sense Disambiguation.

Unit V: Learning to Classify Text **Hours: 06**
Supervised classification, Further examples of Supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.

Unit VI: Extraction Information from Text **Hours: 06**
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

Text Books:
1. Daniel Jurafsky, James H. Martin - Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper - Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Christopher D.Manning and Hinrich Schuetze - Foundations of Statistical Natural Language Processing, MIT press, 1999.

Reference Books:
1.Breck Baldwin, Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Roland R.Hausser - Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press, 2011
5. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
6. Daniel Jurafsky and James H. Martin - Speech and Language Processing, 2nd Edition , Prentice Hall,2008.
7. Charu C.Aggarwal ï ñMachine Learning for Textò, Springer, 2018 Edition.

6KE04 PARALLEL COMPUTING [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of computer architecture.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Parallel Computing by being able to do each of the following:
1. To familiarize students with fundamental concepts, techniques and tools of parallel computing.
2. To explain models and issues in parallel computing
3. To study shared memory paradigm with Pthreads.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Acquire knowledge on large scale parallel system
2. Implement parallel programs for large-scale parallel systems
3. Understand, appreciate and apply parallel and distributed algorithms in problem Solving.
4. Design efficient parallel algorithms and applications
5. Measure the performance of parallel and distributed programs.

Unit I: Introduction to Parallel Computing **Hours: 6**
Motivating Parallelism, Scope of parallel computing, Parallel programming platforms, Implicit Parallelism, Limitations of Memory System Performance, Dichotomy of Parallel computing platforms, Physical organization of parallel platforms, Communication costs in parallel machines, Routing mechanisms for inter connection networks.

Unit II: Principles of Parallel Algorithm Design **Hours: 6**
Preliminaries, Decomposition techniques, characteristics of tasks and interactions, mapping techniques for load balancing, methods for containing interaction overheads, parallel algorithm models.
Unit III: Basic Communication Operations **Hours: 6**
One to all broadcast and all to one reduction, all to all broadcast and reduction, scatter and gather, Circular Shift, sources of overhead in parallel programs, performance metrics for parallel systems, the effect of granularity on performance.

Unit IV: Programming Using Message Passing Paradigm **Hours: 6**
Principles of message-passing programming, Building blocks, Message passing interface (MPI) Topologies and embedding, Overlapping computation with communication, Collective communication and computation operation.

Unit V: Programming Shared Address Space Platforms **Hours: 6**
Thread basics, Why threads?, POSIX thread, Thread basics, Synchronization primitives in Pthreads, controlling thread and synchronization attributes, Composite synchronization constructs.

Unit VI: Sorting **Hours: 6**
Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort, Quick Sort, Bucket Sort, Sample Sort, Enumeration Sort and Radix Sort. Graph Algorithm: Definitions and representation, Primœs Algorithm, Single-Source: Dijkstraœs Algorithm, All-Pairs Shortest Paths: Dijkstraœs Algorithm, Floydœs Algorithm, Connected components: A Depth-First Search Based Algorithm.

Text Books:
[1] Ananth Grama, Vipin Kumar, òIntroduction to parallel computingò, Second edition, 2007.
[2] Cameron Hughes, Tracey Hughes, òParallel and Distributed Programming using C++.Pearson education, 2005

Reference Books:

[1] Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.)
[2] R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.
[3] Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.

6KE04 SENSORS AND ACTUATORS [L-3, T-0, C-3]

Course Prerequisite: Internet of Things, Micro-technology

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Sensors and Actuators by being able to do each of the following:
1. To understand the fundamentals of sensors and actuators
2. An exposure to sensors and its importance in the real world
3. To understand functional safety in machinery and emergency stop applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Fabricate some of those sensors
2. Simulate sensors and characterize before fabricating it
3. Design application with sensors and actuators for real world

Unit I: **Hours: 7**
Introduction: Sensors and Actuators, Technologies related to Sensors: Data Logger, Metal Detector, Photoelectric Sensor, Global Positioning System, Wireless Sensor Network, Sonar, Echo Sounding, Level Sensor, Biosensor, Blood Glucose Monitoring, Load Cell

Unit II: **Hours: 7**
Application of Sensors: On-board Automobile Sensors, Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Medical Diagnostic Sensors, Sensors for Environmental Monitoring.

Unit III: **Hours: 7**
Varied Types of Actuators: Pneumatic Actuator, Hydraulic Cylinder, Linear Actuator, Plasma Actuator, Rotary Actuator

Unit IV: **Hours: 7**
Actuators: Technologies and Devices- Pneumatic Motor, Pneumatic Cylinder, Hydraulic Press, Jackscrew, Hoist (Device), Electroactive Polymers, Roller Screw, MEMS Magnetic Actuator.

Unit V: **Hours: 7**
Remote Sensing: An Overview- Water Remote Sensing, Remote Sensing, Lidar, ERDAS Imagine, TerrSet, Remote Sensing (Archaeology)

Unit VI:
Rader and its application: Radar, Radar Imaging, Radar Navigation. [**Hours: 7]**

Text Books:
1. Princeton Brown, ñSensors and Actuators: Technology and Applicationsò, Library Press, 2017.
2. D. Patranabis, ñSENSORS AND TRANSDUCERSò, Second Edition, PHI Learning Private Limited, 2003.

Reference Books:
1. D.A. Hall and C.E.Millar, ñSensors and Actuatorsò, CRC Press, 1999.
2. Nathan Ida, ñSensors, Actuators, and their Interfaces: A multidisciplinary introduction (Materials, Circuits and Devices)ò, Large Print, 2011.

6KE04 DIGITAL MEDIA PROCESSING L-3, T-0, C-3

Course Pre-requisite: Basic Knowledge of Multimedia, Graphics & Visualization.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Digital Media Processing by being able to do each of the following:
1. Understand media objects
2. Draw on a rigorous combination of theory, analysis and hands-on digital work in development of original ideas in digital media
3. Understand the process of working with users in bringing ideas from concept to production

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe Multimedia components and representation.
2. Discuss color in Image and Video and explore fundamentals concepts in video
3. Compare and contrast different compression algorithms.
4. Apply Audio and Video compression techniques to media to improve efficiency.

Unit I: Hours: 06
Multimedia Authoring and Data Representations: Introduction. Components of Multimedia. Hypermedia and Multimedia. Overview of Multimedia Software Tools, Multimedia Authoring, VRM. Graphics and Image Data Representations: 1- Bit Images, 8-Bit Gray-Level Images, 24- Bit Color Images, 8-Bit Color Images, Color Lookup Tables, Popular Image File Formats.

Unit II: Hours: 07
Color in Image and Video Color Science, Color Models in Images, Color Models in Video. Fundamental Concepts in Video: Types of Video Signals, Component Video, Composite Video, S-Video, Analog Video, NTSC Video, PAL Video, SECAM Video, Digital Video.

Unit III: Hours: 07
Basics of Digital Audio: Digitization of Sound, Digitization, Nyquist Theorem, Signal-to-Noise Ratio (SNR), Signal-toQuantization-Noise Ratio (SQNR), MIDI: Musical Instrument Digital Interface. Hardware Aspects of MIDI, Structure of MIDI Messages, General MIDI, MIDI-to-WAV Conversion.

Unit IV: Hours: 07
Multimedia Data Compression: Lossless Compression Algorithms: Basics of Information Theory, Run-Length Coding, Variable-Length Coding , Dictionary-Based Coding, Arithmetic Coding, Lossy Compression Algorithms: Introduction, Distortion Measures, Quantization, Uniform Scalar Quantization, No uniform Scalar Quantization, Image Compression Standard: The JPEG Standard.

Unit V: Hours: 07
Basic Video Compression Techniques: Introduction, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261 Encoder and Decoder, MPEG-1, Motion Compression in MPEG-1, MPEG-2, Supporting Interlaced Video, MPEG-2 Scalabilities, Other Major Differences from MPEG-1.

Unit VI: Hours:06
Basic Audio Compression Techniques: ADPCM in Speech Coding, Vocoders, Phase Insensitivity, Channel Vocoder, Format Vocoder, Linear Predictive Coding. Audio Compression: Psychoacoustics, Equal-Loudness Relations, Frequency Masking, Temporal Masking, MPEG Audio, MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithm.

Text Book: Ze-Nian, Li, Mark S. Drew ñFundamentals of Multimediaò (Pearson Education)

Reference Books:
1. Rajan Parekh ñPrinciples of Multimedia ñ (Tata McGraw-Hill)
2. S.J. Gobbs & D.C. Tsichritzis ñMultimedia Programmingò. Addison Wesley 1995
3. P.W. Agnew & A.S. Kellerman ñDistributed Multimediaò. , Addison Wesley 1996
4. F. Fluckiger,ò Understanding Networked Multimediaò. Prentice-Hall 1995

6KEO5 COMPUTATIONAL BIOLOGY [L-3, T-0,C-3]

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:
1. To familiarize the students with most basic and useful algorithms for sequence analysis
2. To aware the students with basic file formats
3. To transform the basic molecular data for interpreting their patterns for various analysis
4. To compare genomes of different species, gene finding, and gene regulation.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.

2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems, and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

Unit I: Cellular and Molecular Biology Fundamentals **Hours: 6**
The structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: Sequence Alignments **Hours: 6**
Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequeces Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: Pair wise Sequence Alignments & Database Searching **Hours: 6**
Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, Aligning complete genome sequences.

Unit IV: Patterns Profiles and Multiple Alignments **Hours: 6**
Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: Revealing Genome Features **Hours: 6**
Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: Gene Detection and Genome Annotation **Hours: 6**
Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:
1. Understanding Bioinformatics, Marketa Zvelbil and Jeremy O. Baum, Garland Sceincem Taylor & Francis Group, LLC
2. Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:
1. Bioinformatics Algorithms ï Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.
2. Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.
3. Bioinformatics computing, Bergeron, B. P. (2003), Prentice Hall Professional.
4. Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.
5. Bioinformatics for dummies, Claverie, J. M., & Notredame, C. (2011), John Wiley & Sons.
6. Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

6KSO5 CYBER LAWS & ETHICS L-3,T-0,C-3]

Course Prerequisite: Basic Knowledge of Internet.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:
1. Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
2. Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
3. Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
4. Understand Criminal Liability, Cyber Crime implications and challenges.
5. Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime.

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:
1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Unit I: **Hours: 6**
Information Technology & Cyber Crimes: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: **Hours: 6**
Technology & Forms of Cyber Crimes: Influence of Technology on Criminality, Forms of Cyber Crimes. Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: **Hours: 6**
Cyber Crimes 'and Global Response: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000, Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: **Hours: 6**
Mens Rea & Criminal Liability: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: **Hours: 7**
Cyber Crimes : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes :National and International Endeavours: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavours of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO),Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues.

Unit VI: **Hours:7**
Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges.
Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book: Dr Pramod Kr.Singh, ñLaws on Cyber Crimes [Along with IT Act and Relevant Rules]ò Book Enclave Jaipur India.

Reference Books:
1. Craig B, ñCyber Law: The Law of the Internet and Information Technologyò. Pearson Education.
2. Pawan Duggal, ñCyber Lawsò Universal Law Publishing.
3. K.Kumar,ò Cyber Laws: Intellectual property & E Commerce, Securityò, 1st Edition, Dominant Publisher, 2011.
4. Rodney D. Ryder, ñGuide to Cyber Lawsò, Second Edition, Wadhwa And Company, New Delhi, 2007.
5. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
6. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
7. Sharma, S.R., ñDimensions of Cyber Crimeò, Annual Publications Pvt. Ltd., First Edition, 2004.
8. Augastine, Paul T., ñCyber Crimes and Legal Issuesò, Crecent Publishing Corporation, 2007.

6KE05 INTELLECTUAL PROPERTY RIGHTS [L-3,T-0,C-3]

Course Prerequisite: Basic knowledge of Communication skills, Soft skills, Presentation and Ethics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:
1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret.
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

Unit I: Overview of Intellectual Property Rights **Hours: 06**
Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

Unit II: Patents **Hours: 08**
Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Unit III: Copyrights **Hours: 06**
Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties ï Related Rights - Distinction between related rights and copyrights.

Unit IV: Trademarks **Hours: 07**
Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Unit V: Design & Geographical Indication **Hours: 07**
Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Unit VI: IPR: Current Contour **Hours: 06**
India`s New National IP Policy, 2016 ï Govt. of India step towards promoting IPR ï Govt. Schemes in IPR ï Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:
1. K. V. Nithyananda (2019), ñIntellectual Property Rights: Protection and Managementò, IN: Cengage Learning India Private Limited.
2. P. Neeraj and D. Khusdeep (2014), ñIntellectual Property Rightsò, PHI learning Private Limited.

Reference Books:
1. Deborah E. Bouchoux, ñIntellectual Property for Paralegals ï The law of Trademarks, Copyrights, Patents & Trade secretsò, 4th Edition, Cengage learning, 2012.
2. N. S. Gopalakrishnan and T. G. Agitha, ñPrinciples of Intellectual Propertyò, Eastern Book Company, Lucknow, 2009.
3. M. M. S. Karki, ñIntellectual Property Rights: Basic Conceptsò, Atlantic Publishers, 2009.
4. Ganguli Prabuddha, ñIntellectual Property Rights--Unleashing the Knowledge Economyò, Tata McGrawHill, 2001.
5. V. K. Ahuja, ñLaw relating to Intellectual Property Rightsò. India, IN: Lexis Nexis, 2017.
6. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
7. Ajit Parulekar and Sarita DôSouza, Indian Patents Law ï Legal & Business Implications; Macmillan India ltd, 2006.
8. B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
9. Ganguli Prabuddha, ñGearing up for Patentsé The Indian Scenarioò, Universities Press, 1998.

6KE06 SOFTWARE ENGINEERING - LAB [P-2, C-1]

Course Prerequisite: A Scripting Language, IDEs (Integrated Development Environment), Databases, Software Development Life Cycle (SDLC)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. Impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner
2. Present case studies to demonstrate the practical applications of different concepts
3. Provide a scope to the students where they can solve small, real-life problems
4. All the while it is intended to present Software Engineering as an interesting subject to the students where learning and fun can go alongside.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand basic Software engineering methods and practices, and their appropriate application.
2. Describe software process models such as the waterfall and evolutionary models.
3. Discuss role of project management including planning, scheduling and, risk management.
4. Explain data models, object models, context models and behavioral models.
5. Understand of different software architectural styles and Process frame work.

List of experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

[1] Identifying the Requirements from Problem Statements Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
[2] Estimation of Project Metrics Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
[3] Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
Use case diagrams |,Actor , Use Case , Subject , Graphical Representation , Association between Actors and Use Cases , Use Case Relationships , Include Relationship , Extend Relationship, Generalization Relationship , Identifying Actors , Identifying Use cases , Guidelines for drawing Use Case diagrams

[4]E-R Modeling from the Problem Statements
Entity Relationship Model , Entity Set and Relationship Set , Attributes of Entity , Keys , Weak Entity , Entity Generalization and Specialization ,Mapping Cardinalities , ER Diagram , Graphical Notations for ER Diagram , Importance of ER modeling
[5] Identifying Domain Classes from the Problem Statements
Domain Class , Traditional Techniques for Identification of Classes ,Grammatical Approach Using Nouns , Advantages , Disadvantages ,Using Generalization ,Using Subclasses , Steps to Identify Domain Classes from Problem Statement , Advanced Concepts
[6] State chart and Activity Modeling State chart Diagrams , Building Blocks of a Statechart Diagram , State , Transition , Action , Guidelines for drawing Statechart Diagrams , Activity Diagrams , Components of an Activity Diagram, Activity , Flow , Decision , Merge , Fork ,Join , Note , Partition ,A Simple Example , Guidelines for drawing an Activity Diagram
[7] Modeling UML Class Diagrams and Sequence diagramsStructural and Behavioral aspects , Class diagram , Elements in class diagram , Class , Relationships , Sequence diagram , Elements in sequence diagram , Object , Life-line bar , Messages
[8] Modeling Data Flow Diagrams Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD , Context diagram and leveling DFD
[9] Estimation of Test Coverage Metrics and Structural Complexity Control Flow Graph, Terminologies , McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity , Optimum Value of Cyclomatic Complexity , Merits , Demerits
[10] Designing Test Suites Software Testing , Standards for Software Test Documentation , Testing Frameworks , Need for Software Testing , Test Cases and Test Suite , Types of Software Testing , Unit Testing , Integration Testing , System Testing , Example , Some Remarks. Software Requirements: Star UML

Text Book: Pressman Roger. S: Software Engineering, A Practitionerôs Approach, TMH.

Reference Books:
1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

6KE07 ALGORITHMICS – LAB [P-2, C-1]

Course Pre-requisite: Any programming language, Discrete Mathematics and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Implement C programs to perform recursive calls using the following searching algorithms.
2. Linear Search when the list is given.
3. Binary Search when the given list is not sorted.
[4] Study and analyze to sort an array of integers using merge sort.
[5] Implement and analyze to sort an array of integers using quick sort.
[6]Write a program to Implement the Closest Pair of Points problem using the divide and conquer strategy.

[7]Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23,12,3,5,89,1,24}
[8] Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
[9] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
[10] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
[9] Implement programs to find minimum cost spanning trees from a given graph using Primös algorithm.
[10]Implement Primös algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
[11] Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.
[12] Implement programs to find the shortest path in a given graph using Dijkstraös algorithm.
[13] Implement programs factorial knapsack problem.
[14] Develop a program to implement Strassenös matrix multiplication algorithm.
[15] Implement programs to implement LCS problems using Dynamic Programming.
[16] Develop a program to implement matrix chain multiplication problems using dynamic programming.
[17] Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
[18] Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
[19] Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
[20] Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

[1] Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
[2] Design and Implement Boyer Moore Algorithm for Pattern Searching.
[3]Design and Implement Topological Sort of a graph using departure time of vertex.
[4] Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
[5]Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education .

Reference Books:
[1] Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
[2] G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
[3] Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill.

6KE09 C Skill Lab IV– LAB (DevOps) [P-2, C-1]

Course Pre-requisite: Basic knowledge on SDLC and STLC.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of DevOps learning by being able to do each of the following:

1. Learn what is Jenkins, continuous integration and where does Jenkins fits into SDLC (Software Development Life Cycle)
2. Learn how to setup Jenkins and use Jenkins on their systems, create and configure jobs in Jenkins
3. Learn how to use and manage plugins, how to create and manage users in Jenkins
4. Learn how to deploy application on server, how to work with multiple nodes
5. Learn how to create pipelines

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Install and setup of Jenkins on your systems
2. Create and run jobs in Jenkins
3. Add and manage plugins. Use plugins in jobs
4. Create and run pipelines in Jenkins
5. Setup, configure, deploy jobs

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle

4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

List of Experiments beyond Syllabus: (Maximum 05)

[1] Learn how to setup Jenkins on docker
[2] Learn how to do Jenkins maintenance
[3] Learn how to work with Git and Jenkins

Text Book: John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

Reference Books:
[1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
[2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
[3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress.

6KE08 EMERGING TECHNOLOGY - LAB II

6KE08 Department Professional Elective Lab II is based on 6KE04 Professional Elective-II. Tentative FOSS Tools & Technology for Practicalôs are as follows:
AI : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob
Cloud : Stack, FOSS cloud Eucalyptus
IoT : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring
Multimedia : Inkscape, GIMP, Krita, Scribus, RawTherapee.

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SYLLABUS PRESCRIBED FOR B.E. (INFORMATION TECHNOLOGY) SEM. V

5IT01 DATABASE MANGEMENT SYSTEMS

Course Objectives:

1. Identify role of database system, find out its applications and learn about database file systems.
2. Understand concept of designing database schema and its mapping to relational table.
3. Apply the concepts of database integrity and security, encryption, authorization and Normalization.
4. Evaluate query expression, query cost, query optimization and different operation.
5. Understand the concept of transaction management and its properties.
6. Understand concept of concurrency control and various type of protocol.

Course Outcomes:

1. To understand concept of database system.
2. To understand and apply the concept related with data model
3. Apply concepts of database querying, integrity and security using SQL.
4. To understand query processing and query optimization.
5. To understand concept of transaction management and its properties.
6. To understand the concept of Concurrency control and study of various database protocols.

Unit I: **Introduction:** Database, types of databases, DBMS, Purpose of DBMS & its Applications, RDBMS, File System, DBMS Architecture & its types, DBMS: SQL, MYSQL, ORACLE, PostgreSQL, DB2, SQL Server, Database Users and Administrator **Data Models:** Types of data Models: network, relational, object based data model; Data model schema, Data dependence, types of database languages, ACID properties. E-R Model Concepts, E-R diagram Notations, Mapping Constraints, DBMS Keys, E-R diagram to Table conversion.

Unit-II: **Relational Data Model:** Concepts, Relational algebra, Join operation, Integrity constraint nd its type, relational calculus, Normalization: functional dependencies, Decomposition, Domain & data dependency, types of Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF; **Transaction processing:** Operations on transaction**,** Properties: Atomicity, Consistency, Isolation and Durability, States, schedule, deadlock in DBMS.

Unit-III: **SQL Introduction:**

SQL: Characteristic, advantages, data types, operators, wildcard operators, expressions, **Database commands:** create, drop, select and show database, Create table, drop table, Query with Select statements, Insert statement, Update statement, Delete statement with use of where, and, or clauses, Use of like and top clause, Alter command, Distinct Command, View in SQL, Create view using one or multiple table, delete view, Index creation & Drop, Null Values, SQL sub queries rules, sub queries using select, insert, update, delete statements, **SQL clauses:** having, group by, order by, join, **SQL Aggregate functions:** Count, sum average, max, min; Date function, **SQL Join:** inner, left, right, full, **SQL Set Operations**, Cursors, triggers

Unit-IV: **Concurrency Control:** Lock based protocol, Timestamp based schedulers,Validation based protocol, Serializability of scheduling, multiple granularity, and Concurrency Control schemes.

Unit-V: **Database Security:** Authentication, Authorization and access control, DAC, Mandatory Access Control and Role-Based Access Control models, Intrusion detection, SQL injection.

Unit-VI: **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Book: Korth, Sudarshan : Database System Concept , Mc Graw Hill, 6th Edition

Reference Books:

1. Raghu Ramkrishnan : Database system
2. C.J.Date : Database System, 7th ed.
3. Connolly &Begg : Database System, Low Price Ed.

5IT02: THEORY OF COMPUTATION

Course Prerequisite: Discrete Mathematics, Data Structures.

Course Objectives:
1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability.

Course Outcomes:
On completion of the course, the students will be able to
1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines :
Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar :
Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs (proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages:
Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata:
Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines:
Formal definition of a Turing Machine, Design of TM, Computable Functions, Church‟s hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability:
Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory.

Text Books:
1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata .

Reference Books:
1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill, 2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. Vivek Kulkarni: Theory of Computation, OUP India, 2013.

5IT03 SOFTWARE ENGINEERING

Course Objectives:
1. To understand the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2. To know methods of capturing, specifying, visualizing and analyzing software requirements.
3. To learn about project planning, execution, tracking, audit and closure of project.
4. To introduce principles of agile software development, the SCRUM process and agile practices.
5. To understand project management through life cycle of the project.
6. To understand current and future trends and practices in the IT industry.

Course Outcomes:
1. To identify unique features of various software application domains and classify software applications.
2. To analyze software requirements by applying various modeling techniques.
3. To choose and apply appropriate lifecycle model of software development.
4. To describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
5. To understand IT project management through life cycle of the project and future trends in IT Project Management.

Unit I: Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. W5HH principles, critical practice.

Unit II: Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: System Engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

Unit VI: Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitioner‟s Approach, TMH. (5/e)

Reference Books:

1. Fairly R: Software Engineering (McGraw Hill)
2. Davis A: Principles of Software Development (McGraw Hill)
3. Shooman, M.L: Software Engineering (McGraw-Hill)

5IT04 PROFESSIONAL ELECTIVE - I (i) INFORMATION SECURITY SYSTEM

Course Objectives:

1. Understand the basics of Information Security
2. Know the legal, ethical and professional issues in Information Security
3. Know the aspects of risk management
4. Become aware of various standards in this area
5. Know the technological aspects of Information Security

Course Outcomes:

The learning outcomes are:

1. Study the foundational theory behind information security.
2. Discuss the basic information security.
3. Illustrate the legal, ethical and professional issues.
4. Discuss the aspects of risk management.
5. Summarize various standards for information security.
6. Explain the security techniques.

Course Contents:

UNIT I: Introduction to Information Security: History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II : Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

UNIT III : Legal, Ethical, and Professional Issues in Information Security: Law and Ethics in Information Security, International Laws and Legal Bodies, Ethics and Information Security.

UNIT IV : Security Analysis: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies.

UNIT V : Planning for Security: Information Security Planning and Governance. Information Security Policy, Standards, and Practices, the Information Security Blueprint, Security Education, Training, and Awareness Program. Continuity Strategies .

UNIT VI : Cryptography: Foundations of Cryptology, Cipher Methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems.

TEXT BOOK : Michael E Whitman and Herbert J Mattord, ñPrinciples of Information Securityò, Vikas Publishing House, New Delhi, 2003.

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, ñ Handbook of Information Security Managementò, Vol 1-3 CRC Press LLC, 2004.111
2. William Stallings ,"Cryptography and Network Security: Principles and Practice", 6th Edition, Prentice Hall
3. M. Stamp, ñInformation Security: Principles and Practice,ò 2nd Edition, Wiley, ISBN: 0470626399, 2011.
4. Nina Godbole, ñ Information Systems Securityò, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
5. Mark Merkow, ñ Information Security-Principles and Practicesò, Pearson Ed. 978-81-317-1288- 7.

5IT04 PROFESSIONAL ELECTIVE - I (ii) DATA SCIENCE & STATISTICS

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Data Science & Statistics by being able to do each of the following:

1. Organize, manage and present data.
2. Understand basic theoretical and applied principles of statistics.
3. Analyze statistical data using measures of central tendency, dispersion and location.
4. Introduce students to the basic concepts and techniques of Data Science.
5. Acquire knowledge of regression methods and classification methods.

Course Outcomes:

On completion of the course, the students will be able to:

1. Gain knowledge about basic concepts of Data Science & Statistics.
2. Demonstrate proficiency with statistical analysis of data.
3. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
4. Develop the ability to build and assess data-based models.
5. Evaluate models generated from data

UNIT I Python for Data Science :

Mean, Median, Mode, Variance, Standard Deviation Numpy: The Basics of NumPy Arrays, Universal Functions, Aggregators, Broadcasting, Fancy Indexing; Pandas: Introducing Pandas Objects, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat, Append, merge and join, aggregation and grouping , pivot Tables.

UNIT II Exploratory Data Analysis and Statistics:

EDA: Matplotlib and Seaborn: Simple Line Plots, Simple Scatter Plots, Density and Contour Plots, Histograms, Binnings, and Density ,Random Sampling, Distributions: Uniform Distribution, Normal Distribution, Poissonûs Distribution, Binomial Distribution.

UNIT III Statistical Experiments and Significance Testing:
Hypothesis Test: The Null Hypothesis, Alternative Hypothesis, One way, Two way Hypothesis Test; Statistical Significance and P-Values: P-value, alpha, type 1 error , type 2 error; t-Tests, Degrees of Freedom, ANOVA: F statistics, Two-way Anova; Chi-Square Test: A Resampling Approach.

UNIT IV Regression Techniques:
Introduction to Machine Learning, Hyper parameter and Model Validation, Feature engineering, Assumptions in Regression, Simple Linear Regression, Multiple Linear Regression.

UNIT V Classification: Logistic regression:
Logistic Response Function and Logit, Predicted Values from Logistic Regression, Interpreting the Coefficients and Odds Ratios; Evaluating Classification Models: Confusion Matrix, Precision, Recall, and Specificity, ROC Curve, AUC

UNIT VI Decision Tree and Radom Forest:
A Simple Example, The Recursive Partitioning Algorithm, Measuring Homogeneity or Impurity, Stopping the Tree from Growing, Predicting a Continuous Value; Random Forest

Text Books:

[1] Practical Statistics for Data Scientists By Peter Bruce, Andrew Bruce, O'Reilly Media, Inc.

[2] Python Data Science Handbook By Jake VanderPlas O'Reilly Media, Inc

Reference Books:

[1] Introduction to Machine Learning with Python By Andreas C. Müller, Sarah Guido, O'Reilly Media, Inc.

[2] Think Stats By Allen B. Downey O'Reilly Media, Inc.

5IT04 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS

Course Objectives:
The educational objectives of this course are:

To explore various components of Internet of things
To Recognize various devices, sensors and applications
To build a couple of applications that will communicate with IoT hardware and software.
To understand the IoT Reference Architecture and Real World Design Constraints.

Course Outcomes:
At the end of this course, the student would be able:

- To design small scale as well as sophisticated embedded system.
- To implement standalone application and GUI based application for real life projects.
- To recognize the role of professional societies in providing solution for real world problem.

Unit I: Introduction to IoT:
Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

Unit II: M2M to IoT:
From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains.

Unit III: M2M vs IoT An Architectural Overview:
Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.
Unit IV: IoT Reference Architecture:
Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design in IoT world- Introduction, Technical design Constraints.

Unit V: Developing IoT solutions:
Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi. Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities

Unit VI: Security, Privacy & Trust:
IoT security challenge, Spectrum of security considerations, Unique security challenges of IoT devices, Internet of things privacy background, Unique privacy aspects of internet of things, Trust for IoT.

Text Books:

[1] Vijay Madisetti and Arshdeep Bahga, ñInternet of Things (A Hands-on-Approach)ò, 1 st Edition, VPT, 2014
[2] Peter Waher, ñLearning Internet of Thingsò, PACKT publishing, BIRMINGHAM ï MUMBAI

Reference Books:

[1] ñInternet of Things: Converging Technologies for Smart Environments and Integrated Ecosystemsò, Ovidiu Vermesan, Peter Friess, River Publishers.

[2] Bernd ScholzReiter, Florian Michahelles, ñArchitecting the Internet of Thingsò, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

5IT05 OPEN ELECTIVE - I (I) SOFT SKILLS & INTERPERSONAL COMMUNICATIONS

Course objectives:
1. Explain and elaborate fundamentals of communication
2. Apply knowledge of verbal and nonverbal communication in business cases
3. Elaborate the barriers of communication and apply it improve communication

Course outcomes:
Student will be able to
1. Use and apply interaction skills
2. Use and apply leadership skills
3. Use and apply negations skills.

Unit I: Introduction, Need for Communication, Process of Communication, Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication, Inter-cultural, Intra-cultural, Cross-cultural and International communication, Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Unit II: Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos, Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids, Report Writing.

Unit III: Barriers to Communication, Improving Communication Skills, Preparation of Promotional Material, Non-verbal communication, Body language Postures and gestures, Value of time , Organizational body language, Importance of Listening, Emotional Intelligence.

Unit IV: Individual Interaction and skills, Basic Interaction Skills ï Within family, Society, Personal and interpersonal intrapersonal skills, Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking, Self Awareness and Self Esteem, Group Influence on Interaction Skills, Human relations examples through role ï play and cases.

Unit V: Leadership Skills, Working individually and in a team, Leadership skills, Leadership Lessons through Literature, Team work & Team building, Interpersonal skills ï Conversation, Feedback, Feed forward, Interpersonal skills ï Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team ï work Conflict Management ï Types of conflicts, how to cope with them, Small cases including role ï plays will be used as teaching methodology.

Unit VI : Negotiation Skills (To be Taught through Role Plays and Cases) ,Types of Negotiation ,Negotiation Strategies, Selling skills ï Selling to customers, Selling to Superiors, Selling to peer groups, team mates & subordinates, Conceptual selling, Strategic selling, Selling skills ï Body language,

Books Recommended:
1. Peggy Klaus, The Hard Truth about Soft Skills.
2. Nitin Bhatnagar. Effective Communication and Soft Skills. Pearson Education India.
3. Eric Garner. Team Building. 4. Wendy Palmer and Janet Crawford. Leadership Embodiment.

5IT05 OPEN ELECTIVE - I (II) COMPUTATIONAL BIOLOGY

Unit I: Introduction: Molecular Biology Introduction, Cell, Nucleus, Genes, DNA, RNA, Proteins, And Chemical structure of DNA, RNA, Transcription and Translation Process. Protein Structure and Functions, Nature of Chemical Bonds Molecular Biology tools, Polymerase chain reaction

Unit II: Sequence Alignment: Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Multiple sequence Alignments, Gene Prediction, Statistical Approaches to Gene Prediction

Unit III: Genome Algorithms: Genome Rearrangements, Sorting by Reversals, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time, Protein Sequencing and Identification, the Peptide Sequencing Problem, Introduction to Nature Inspired Algorithms.

Unit IV: Microarray Data Analysis: Microarray technology for genome expression study, Image analysis for data extraction, Data analysis for pattern discovery, gene regulatory network analysis

Unit V: Phylogenetic: Neighborôs relation method, Neighbor-joining method, Maximum likelihood Approaches, Multiple Sequence Methods Structural Biology, Sequence, organisms, 3D structures, complexes, Assemblies, Case Studies, examples

Unit VI: Drug Discovery &Next Gen Sequencing: Similarities/differences between drugs and receptors, protein-ligand docking, Massively Parallel Signature Sequencing (MPSS), SOLiD sequencing, Single molecule real time (SMRT) sequencing .

Text Books:

1) Dan E. Krane, Michael L. Raymer, ñFundamental Concepts of Bioinformatics,ò, Pearson Education, Inc. Fourth Edition, 9780805346336.
2) Harshawardhan P. Bal, ñBioinformatics Principles and Applicationsò, Tata McGraw-Hill, seventh reprint, 9780195692303.

Reference Books:

1) Teresa Attwood, David Parry-Smith, ñIntroduction to Bioinformaticsò, Pearson Education Series, 9788180301971
2) R. Durbin, S. Eddy, A. Krogh, G. Mitchison., ñBiological Sequence Analysis: Probabilistic Models of proteins and nucleic acidsò, Cambridge University Press, 9780521629713.

5IT05 OPEN ELECTIVE - I (III) CYBER LAW & ETHICS

Course Objectives:

1. To identify and describe the major types of cyber crime.
2. To identify cyber crime vulnerabilities and exploitations of the Internet.
3. To understand the law with regards to the investigation and prosecution of cyber criminals.
4. To identify appropriate law enforcement strategies to both prevent and control cyber crime.
5. Explain jurisdictional challenges that nations face when responding to cybercrime

Course outcomes:

1. Understand Cyber laws
2. Describe Information Technology act and Related Legislation
3. Demonstrate Electronic business and legal issues.
4. Interpret Cyber Ethics.

Unit I: Introduction to Cyber law: Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, CyberspaceWeb space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Unit II Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Unit III : Cyber law and Related Legislation: Patent Law, Trademark Law, Copyright, Software ï Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Unit IV : Electronic Business and legal issues: Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

Unit V: Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Unit VI : Case Study On Cyber Crimes: Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

Reference Books:

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
3. Information Security policy & Implementation Issues, NIIT, PHI
4. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
6. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
7. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, New York, (2011) .

5IT06 DATABASE MANGEMENT SYSTEMS - LAB

1. **Practical 1**: To Study a Database Modeling Tool. Study of Data Modeling Tools
   - Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
     - Logical / Physical Modeling
     - Adding an entity / its attributes , relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
     - Forward / reverse engineering
     - Details of forward engineering / schema generation
     - Steps to generate the schema

2. **Practical 2**: To Study and implement DDL Commands
   Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.
     - Creating the proper tables
     - Insert the data into it.
     - Study Dropping and Altering the Tables. Study the cascaded deletes.

3. **Practical 3**: To Study and implement DML Commands-I
   - SQL queries : Write and execute different SQL queries
   - Execute Simple queries using SELECT, FROM, WHERE clauses,
   - In Where clause use different predicates involving OR,AND, NOT
   - Rename operation
   - Tuple Variables
   - Write SQL for various String operations (%,_,*)
     - Match beginning with
     - Match ending with
     - Substring
     - Match exactly n characters
     - Match at least n characters
   - Sort the output of the query using **Order by**
   - Write SQL using **Having**

4. **Practical 4** : To Study and implement DML Commands-II
   Write SQL queries and perform
   - Set membership operations
   - In, not in
   - Some
   - All
   - Exists and not exists, Test for emptyness using exists, not exists
   - Test for absence of duplicates.
   - Nested queries

5. **Practical 5**. Study and implement aggregation functions.
   Write different queries using following Aggregate functions
   a. Min (minimum 3 SQL queries)
   b. Max (minimum 3 SQL queries)
   c. Avg (minimum 3 SQL queries)
   d. Sum (minimum 3 SQL queries)
   e. Count (minimum 3 SQL queries)

6. **Practical 6:** Write SQL to create Views and Indexes.
7. **Practical 7**: Write SQL to perform the modifications to the database
8. **Practical 8** : PL /SQL
9. **Practical 9** : Database Access Using Cursors
   Write a trigger to find the names and cities of customers who have more than xyz in any account.
10. **Practical 10** : Triggers
    - Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
    - Write a trigger for dealing with blank cities (set the city field to null when it is blank)
11. **Practical 11**: Procedures, functions
    - Write atleast 2 functions, and demonstrate its use
    - Write atleast 2 procedures, and demonstrate its use
12. **Practical 12** : Web Programming with PL/SQL. **(Contents Beyond Syllabus)**
    HTTP, A Simple Example., Printing HTML Tables., Passing Parameters., Processing HTML Forms., Multi-Valued Parameters.
13. **Practical 13**: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) **(Contents Beyond Syllabus)**
14. **Practical 14**: Web Programming with Java Servlets. **(Connecting to the database) (Contents Beyond Syllabus)**
    A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.
15. **Practical 15**: PHP : Develop a simple application to access the database using PHP **(Contents Beyond Syllabus)**
16. Study of Open Source NoSQL Databases
17. Based on the concepts covered in text create a Mini Project:

Suggested Topics:

i. Bank database (Given in Korth book)
ii. University Database (Given in Korth book)
iii. Airline Flight Information System.
iv. Library Database Application.
v. University Student Database.
vi. Video Chain Database.
vii. Banking Database.
viii. BiBTeX Database.
ix. Music Store Database.
x. Online Auctions Database.
xi. A Web Survey Management System.

5IT07 SOFTWARE ENGINEERING LAB.

Minimum eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units and **a mini project based on the syllabus using case studies.**

LIST OF EXPERIMENTS:

1. Preparing Software Requirements Specifications
2. Identifying Domain Classes from the Problem Statements
3. Modeling UML Class Diagrams and Sequence diagrams
4. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
5. E-R Modeling
6. State chart and Activity Modeling
7. Modeling Data Flow Diagrams
8. Estimation of Project Metrics
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites
11. Preparing Final Project Report

5IT08 PROFESSIONAL ELECTIVE – I (I) INFORMATION SECURITY SYSTEM LAB .

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

5IT08 PROFESSIONAL ELECTIVE - I (II) DATA SCIENCE & STATISTICS

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units

List of Experiments:

Experiment No.	EXPERIMENT DESCRIPTION
01	Study of setting up the Python environment of and how it is useful for data science.
02	Study of Pandas, NumPy, SciPy and Matplotlib Libraries in Python and their importance in data science and statistics.
03	Write a python program to plot a sine wave using Matplotlib library.
04	Write a python program to understand the tokenization of string data.
05	Write a python program to handle the data in series and Data Frame format using NumPy Library.
06	Write a python program to read a csv file and display data from specific rows and specific columns from it.
07	Write a python program to print a 3D plot using matplotlib library.
08	Write a python program to understand the linear regression of data and display it.
09	Write a python program to read a time series data from a csv file and display it in a graph.
10	Write a python program to understand and implement the Naïve Bayes Algorithm.

5IT08 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS

Minimum eight experiments must be completed based on the syllabus uniformly covering each of the units.

LIST OF EXPERIMENTS:
1. To Interface **PRI Motion Sensor** with Raspberry Pi and write a program to control LED.
2. To Interface **Optical Sensor** with Raspberry Pi and write a program to control LED.
3. To Interface **Rain Drop Sensor** with Raspberry Pi and write a program to sound an alarm.
4. To Interface **Moisture Sensor** with Raspberry Pi and write a program to display value.
5. To Interface **Touch Sensor** with Raspberry Pi and write a program to detect and record physical touch.
6. To Interface **Gas Sensor** with Raspberry Pi and write a program to sounds an alarm.
7. To Interface **Pressure Sensor** with Raspberry Pi and write a program to display value.
8. To Interface **Ultrasonic Sensor** with Raspberry Pi and write a program to measure the distance between any two objects.

5IT 09 COMPUTER SKILL LAB - III

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

LIST OF EXPERIMENTS:

Sr. No.	Title for Experiment
1	Understanding and use of HTML & CSS Programming
2	Understanding and use of Java Script
3	Understanding and use of Type Script
4	Introduction to Angular
5	Angular Environment Set up
6	Creating Angular Project and basic introduction about project structure / directory.
7	Understanding Components and how to create components in Angular
8	Understanding of data binding in Angular component and view files.
9	Understanding and use of different types of Angular directives
10	Understanding of modules and routing in angular.
11	Understanding of services and component ́s life cycle method
12	Understanding of package. json file in Angular Project.
13	Understanding of how to fetch data from the API using services.

Pre-requisites -Before proceeding with this Angular tutorial course, students should have a basic understanding of HTML, CSS, and JavaScript, basic oops concept.https://dotnettutorials.net/lesson/creating-angular-project/
Angular Tutorials Links:
https://angular.io/
https://www.javatpoint.com/angular-7-tutorial
https://www.tutorialsteacher.com/angular
https://www.tutorialspoint.com/angular7/index.htm

Reference Books:
1. ñAngular in Action **"by Jeremy Wilken: Manning Publications**
2. ñAngular: Up and Running: Learning Angular, Step by Stepò by Shyam eshadri: Shroff/O'Reilly PUBLICATIONS
3. ñ Beginning Angular with Typescriptò By : Greg Lim
4. ñLearning Angularò By **Aristeidis Bampakos and** Pablo Deeleman **Packt Publishing Limited.**

B.E. SEMESTER VI [INFORMATION TECHNOLOGY]

6IT01 COMPILER DESIGN

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3.To study concept of syntax directed definition and translation scheme for the representation of language
4. To illustrate the various optimization techniques for designing various optimizing compilers.

Course Outcomes:
On completion of the course, the students will be able to:

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiling: Definition of Compiler, Phases of a Compiler, Grouping of Phases, Compiler Construction Tools.
Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, language for specifying lexical analysis, lex and yacc tools, finite automata, from regular expressions to finite automata and state minimization of DFA.

Unit II: Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis.
Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing, The parser generator Yacc.

Unit IV: Syntax Directed Translation: Syntax directed definitions, synthesized and inherited attributes, dependency graphs, Evaluation orders. Construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator.

Unit V: Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, scope of a declaration, Storage Organization, Storage allocation strategies, static allocation, stack allocation, dangling references, heap allocation. Access to non-local names, Parameter passing, Symbol table: Entries, Storage allocation, Hash tables, Scope information.

Unit VI: Intermediate Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. Introduction to Code Optimization, Principal Sources of Optimization.

Text Book: Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education (Low Price Edition).
Reference Books:

[1] D. M. Dhamdhere, Compiler Constructionð Principles and Practice, (2/e), Macmillan India.
[2] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: ñPrinciples, Techniques and Toolsò, Pearson Education Second Edition
[3] Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
[4] K C. Louden ñCompiler Constructionð Principles and Practiceò India Edition, CENGAGE
[5] Bennett J.P., ñIntroduction to Compiling Techniquesò, 2/e (TMH).

6IT02 DESIGN & ANALYSIS OF ALGORITHM

Course Objectives:

1. To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.
2. To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.
3. To explain different computational models (e.g., divide-and- conquer), order notation and various complexity measures.
4. Study of various advanced design and analysis techniques such as greedy algorithms, dynamic programming
5.Synthesize efficient algorithms in Common Engineering situations.

Course Outcomes:

- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
- Able to understand the concept of Backtracking, Polynomial Time & Non Polynomial Time Algorithms.

Unit I: Top-Down Design: Structured Programming, Control Constructs, Procedures & Functions, Recursion. Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.

Unit II: Divide and Conquer: Multiplication Algorithm and its analysis, Application to Graphics Algorithms: Introduction to Triangulation, Covex Hulls.

Unit III: Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Primôs Algorithms, Kruskalôs Algorithm, Dijkstras Shortest Path Algorithm.

Unit IV: Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation. Single Source Shortest Paths

Unit V: Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework-8-Queenôs problem, graph coloring , Some Typical State Spaces, Branch-and-Bound Algorithms.

Unit VI: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.
Text Book: Dave and Dave: ñDesign and Analysis of Algorithmsò Pearson Education
Reference Books:
1. Aho,Hopcroft & Ullman ñThe Design & Analysis of Computer Algorithmsò, Addison-Wesley
2. G. Brassard, P.Bratley: ñFundamentals of Algorithmicsò , PHI
3. Horowitz & Sahani: ñ Fundamental Algorithmsò , Galgotia.
4. Cormen, T.H, Lierson & Rivest: ñ Introduction to Algorithmsò, Mc Graw-Hill .

6IT03 ARTIFICIAL INTELLIGENCE

Course Objectives:
1. Familiarity with basic principles of AI
2. Capable of using heuristic searches
3. Aware of knowledge based systems
4. Able to use fuzzy logic
5. Learn various applications domains AI.

Course Outcomes: Students will be able to

1. Define Artificial Intelligence and identify problems for which solution by AI methods can be devised.
2. Evaluate of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
3. Design and Analysis of informed search algorithms on well formulated problems.
4. Formulate and solve given problem using Propositional and First order logic.
5. Apply reasoning for non-monotonic AI problems.
6. have a basic understanding of some of the more advanced topics of AI such as learning, Understanding, Natural Language Processing.

Unit-I: Introduction to Artificial Intelligence: The AI Problems, The Underlying Assumption, What is an AI Technique; Tic-Tac-Toe**, Problems, Problem Spaces, and Search,** Production Systems, Problem Characteristics , Production System Characteristics, Issues in the Design of Search Programs.

Unit-II: Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, **Uninformed Search Strategies:** Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search.

Unit–III: Informed Search Strategies Generate-and-Test, Hill Climbing, Best-first Search, A* Algorithm, Problem Reduction, AND-OR Graphs, The AO* Algorithm, Constraint Satisfaction, Means ends Analysis.

Unit –IV: Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, **Predicate Logic:** Representing Simple Facts in Logic, Representing Instance and *ISA* Relationships, Computable Functions and Predicates, Resolution, Natural Deduction **Representing Knowledge Using Rules,** Procedural Versus Declarative Knowledge, Logic Programming Forward Versus Backward Reasoning.

Unit-V: Symbolic Reasoning Under Uncertainty Introduction to Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function. Probability and Bayesô theorem, Bayesian Networks.

Unit-VI: Understanding What is Understanding?, Understanding as Constraint Satisfaction, **Natural Language Processing,** Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking, **Common Sense** Qualitative Physics.

TEXT BOOK: Artificial Intelligence ï Elaine Rich, Kevin Knight, Nair (Third Edition) [Mc Graw Hill]

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and expert system ï Dan W. Patterson
2. Introduction to Artificial Intelligence ï Rajendra Akerkar
3. Nils Nilson: ñ Principles of Artificial Intelligenceò.(Addison-Wesley)
4. R. J. Winston: ñ Artificial Intelligenceò.(Wiley)
5. Patterwson ñIntroduction to Artificial Intelligence and Expert Systemsò (PHI).
6. Rolston ñPrinciples of Artificial Intelligence and Expert Systemsò, McGraw Hill.

6IT04 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Cryptography & Network Security by being able to do each of the following:

ÅTo understand the fundamental concepts of Cryptography & Network Security.
ÅTo familiarize the students with basic taxonomy and terminology of Cryptography & Network Security.
ÅTo understand various protocols for network security to protect against the threat in the network.
ÅTo understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes:
On completion of the course learner will be able to

- Understand the principles and fundamental concept of Cryptography & Network Security.
- To learn Encryption and Decryption Techniques.
- Evaluate various Key Encryption Algorithms.
- Understand IP Security system and protocols.
- Identify and understand Network Security controls.
- Explore web and system security and its applications to digital world.

Unit I: Introduction : OSI Security Architecture, Security Attacks: Threats, Vulnerability and Controls, Security Services: Confidentiality, Integrity, Availability, Introduction to Cryptography, Conventional Encryption: Conventional encryption model - classical encryption techniques.

Unit II: Encryption and Decryption: Characteristics of Good Encryption Technique: Properties of Trustworthy Encryption Systems; Types of Encryption Systems: Based on Key, Based on Block; Confusion and Diffusion; Cryptanalysis.

Unit III: Symmetric Key Encryption and Public Key Encryption: Data Encryption Standard (DES) Algorithm: Double and Triple DES, Security of the DES; Advanced Encryption Standard (AES) Algorithm, DES and AES Comparison, RSA Technique, Digital Signature.

Unit IV IP Security: Overview of IP Security (IPSec); IP Security Architecture; Modes of Operation; Security Associations, Security Parameter Index (SPI), SA Management, Security Policy: Authentication Header (AH); Encapsulating Security Payload (ESP); Internet Key Exchange.

Unit V Network Security: Network Concepts; Threats in Networks, Threats in Transit: Eavesdropping and Wiretapping, Protocol Flaws, Impersonation; Network Security Controls: Architecture, Encryption, Virtual Private Networks, Public Key Infrastructure (PKI) and Certificates.

Unit VI Web and System Security: Web Security: Secure socket layer and transport layer security, Secure Electronic transaction, System Security: Intruders, Viruses and related threads; Network Security Controls: Architecture, Public Key Infrastructure (PKI) and Certificates, Security Features of Trusted Operating Systems.

Text Book: William Stallings, ñCryptography and Network security Principles and Practicesò, Pearson/PHI.

Reference Books:
1. W. Mao, ñModern Cryptography ï Theory and Practiceò, Pearson Education.
2. Wade Trappe, Lawrence C Washington, ñIntroduction to Cryptography with coding theoryò, Pearson.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger ñSecurity in computingò, Prentice Hall of Ind

6IT04 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS

Course Objectives:
1. To make the students aware about the basics concepts of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop and NoSql
3. To discuss the basic concepts and operations of map-Reduce
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce several new algorithms for big data mining like classification, clustering and finding frequent patterns
6. To introduce to the students several types of big data like social media, web graphs and data streams and help them to solve real world problems in for decision support.

Course Outcomes:
On completion of the course the student(s) will be able to
1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques like Hadoop, and NO SQL in big data analytics.
3. Achieve basic knowledge and operations of Map-Reduce
4. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

5. Implement algorithms for Clustering, Classifying and finding associations in Big Data 6. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications.

UNIT I: Introduction to Big Data:
Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.

UNIT II: Introduction to big data frameworks: Hadoop and NoSQL:
Introduction to Hadoop, Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop ,Introduction to NoSQL, NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Mongo DB.

UNIT III: MapReduce Paradigm:
MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce.

UNIT IV: Mining Big Data Stream:
The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter. Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-IndykMotwani Algorithm, Query Answering in the DGIM Algorithm.

UNIT V: Big Data Mining Algorithms:
Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce. Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, K-Nearest Neighbor classifications for Big Data, One Nearest Neighbour.

UNIT VI: Big Data Analytics Applications
Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank, PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm, Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: Content based Recommendation, Collabrative Filtering.

Text Books:
1. Radha Shankarmani, M Vijayalakshmi, òBig Data Analyticsò, Wiley Publications
2. Anand Rajaraman and Jeff Ullman ñMining of Massive Datasetsò, Cambridge University Press.
Reference Books:
1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Alex Holmes ñHadoop in Practiceò, Manning Press, Dreamtech Press.
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf,O'Reilly Publications
5. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited Hadoop: The Definitive Guide by Tom White, O'Reilly Publications.

6IT04 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS

Course Learning Objectives:

- To learn concept behind working of various types of Sensors.
- To understand available sensor to measure each physical parameters used in Industry and normal measurement applications.
- To interface real sensors for meaningful output in Electrical form.

Course Outcomes:

- Concept behind working of measurement systems and different types of sensors and actuators.
- Understanding of electric and magnetic sensors and actuators and their applications.
- Understanding of optical sensors and other sensors and their applications.
- Understanding of smart sensors and their uses.

UNIT I: Introduction:
Definitions, Classification of Sensors and Actuators, General Requirements for Interfacing, Measuring Units. Performance Characteristics of Sensors and Actuators, Input and Output characteristics.

UNIT II: TEMPERATURE SENSORS AND THERMAL ACTUATORS:

Introduction, Thermosensitive Sensors: Thermistors, Resistance Temperature Sensors
and Silicon Resistive Sensors, Thermoelectric Sensors, P-N junction Sensors. Optical and Acoustical Sensors, Thermomechanical Sensors and Actuators.

UNIT III: OPTICAL SENSORS AND ACTUATORS:

Introduction, Optical Units, Materials, Effects of Optical Radiation, Quantum Based Optical Sensors, Photoelectric Sensors, Coupled Charge (CCD) Sensors and Detectors, Thermal-Based Optical Sensors, Optical Actuators.

UNIT IV: ELECTRIC AND MAGNETIC SENSORS AND ACTUATORS:

Introduction, Units, The Electric Field: Capacitive Sensors and Actuators, Magnetic Fields: Inductive Sensors and Hall Effect Sensors, MHD Sensors and Actuators, Magnetic Actuators, Voltage and Current Sensors.

Unit V: MECHANICAL / ACOUSTIC SENSORS AND ACTUATORS :

Introduction, Definitions/Units, Force Sensors, Accelerometers, Velocity Sensing.
Microphones, Acoustic Actuators, Ultrasonic Sensors and Actuators. Piezoelectric Actuators, Resonators and SAW Devices.

Unit VI: MEMS AND SMART SENSORS:
Introduction, MEMS Sensors and Actuators with Applications, Smart Sensors/Actuators Issues. Wireless Sensors and Actuators, Modulation/Demodulation, Encoding/Decoding Sensor Networks.

Text Book: Nathan Ida, ñSensors, Actuators, and their Interfaces: A Multidisciplinary Introductionò, SciTech Publishing.

Reference Books:

1. Patrick F Dunn, ñFundamentals Of Sensors For Engineering And Scienceò CRC Press, Taylor & Francis Group, 2014
2. Patranabis D., "Sensors and Transducers", Prentice-Hall India, 2nd Ed., 2004.
3. Shawhney A. K., "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Sons, 1994.
4. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press,

6IT05 OPEN ELECTIVE II (I) ECONOMIC POLICY IN INDIA

Course Objectives:
1. Student will be able explain and elaborate fundaments Indian economy
2. Student will be able to explain, elaborate and identify the role of agriculture in Indian economy
3. Student will be able to explain elaborate and identify the role of industrial sector in Indian economy.

Course Outcomes:
1. Student will be able to explain, elaborate and indentify the impact of external sector on Indian economy
2. Student will be able to explain, elaborate and indentify the impact monetary and fiscal policies in India
3. Student will be able to explain ,elaborate and analyze the issues of Indian economy.

UNIT - I : Indian Economy and Development Basic characteristics of the Indian economy **-** Major issues of development **-** The determinants of economic development **-** sustainable development **-** Demographic features of Indian population **-** Rural Urban Migration **-** poverty and Inequality.

UNIT - II : The Agricultural Sector The Role of Agriculture in Economic development - Place of Agriculture in the Economy of India - Land Reforms in India - Inter dependency of Agriculture and Industry - Agricultural Finance - Agricultural prices, polices and Food problem - Agricultural development.

UNIT - III : The Industrial Sector A review on Industrial Policy - Role of large scale and small scale Industries in development. Private Sector and public sector - Industrial sickness - Industrial Finance - Industrial monopoly and Multinational corporations - Role of Information Technology in Industrial development.

UNIT - IV : External Sector Structure and Direction of Foreign trade, Balance of Trade & Balance of payments - composition of Trade - Important of Foreign trade for developing economy - Exchange rate - Foreign capital and MNCs in India - Globalisation and its impact on Indian economy - WTO and its impact on the different sectors of the economy.

UNIT V: Monetary and Fiscal Policies in India, Credit and Monetary Policy, Capital Market and its Regulation, Public Finance and Fiscal Policy, Fiscal Federalism in India.

UNIT VI: Some Issues of Indian Economy: National Institution for Transforming India (NITI Aayog), National Development Council (NDC); Developing Grass-Root Organizations for Development: Panchayatiraj; Role of Non Government Organizations (NGOs) and Pressure Groups in Indiaôs Economy. Public Private Partnership (PPP).

Text Books:

1. Ahluwalia, IJ and IMD Little (Eds) (1999), Indian Economic Reforms and Development. (Essays in Honour of Manmohansingh) Oxford University, Press, New Delhi.
2. Bardhan, P.K (9th edition) (1999), The political economy of development in India, Oxford University, Press, New Delhi.

Reference Books:

1. Bawa, R.S and P.S.Raikhy (Ed) (1997) structural changes in Indian economy, Guru Nanak Dev University Press, Amritsar.
2 Brahmananda, P.R. and V.R Panchmukhi (Eds) (2001) Development Experience in the Indian economy: Interstate Perspectives, Bookwel Delhi.
3. Chakravartym .S (1987), Development Planning : The Indian Experience, Oxford University, Press, New Delhi.
4. Government of India, Econimic Survey (Animal) Ministry of Finance, New Delhi.
6. Jaban. B,(1992) The Indian Economy ð problems and prospects, Viking New Delhi.
7. Parikh.K.S (1999) India Development Report ð 1999 ð 2000 Oxford University, Press, NeW Delhi.
8. Reserve Bank of India, Report on currency and finance (Annual) 10. Sri R.K. and B. Chatterjee (2001) Essays in Honour of Prof.P.R.Brahmanandha), Deep & Deep Publications, New Delhi.

6IT05 OPEN ELECTIVE II (II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATION BEHAVIOR

Course Objective:

The objective of the course is to familiarise the students about the different aspects of managing people in the organisations from the stage of acquisition to development and retention.

Course Outcome:

1. To have an understanding of the basic concepts, functions and processes of human resource management
2. To be aware of the role, functions and functioning of human resource department of the organizations.
3. To Design and formulate variours HRM processes such as Recruitment, Selection, Training, Development, Performance appraisals and r Reward Systems, Compensarion Plans and Ethical Behaviour.
4. Develop ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy.
5. Evaluate the developing role of human resources in the global arena.

UNIT I: Introduction: Conceptual foundations; Human aspect of management, Human Relations; Human Resource Management- Concept, Scope and Importance; Competencies of HR Manager: Employer branding and Competency mapping; Changing role of HRM- Workforce diversity, Technological change, Restructuring and rightsizing, Empowerment; TQM, Managing ethical issues.

UNIT II: Human Resource Planning, Job Analysis, and Job Design: Assessing Human Resource requirements; Human resource forecasting; Work load analysis ; Job analysis; Job description and specifications; Job design; Job characteristic approach to job design

UNIT III: Recruitment, Selection, Training, and Development: Factors affecting recruitment; Sources of recruitment (internal and external); Basic selection model; Psychological tests for selection; Interviewing; Placement and Induction; Job Changes-Transfers, Promotions, and Separations; An overview of Training and Development; Emerging trends in Recruitment, Selection, and development.

UNIT IV: Understanding Organisation: Significance of Scientific Study of Human Behaviour, Hawthorn Studies itôs importance & implication, Approaches-Cognitive, Behaviourstic & Social learning framework Human Need, theory, Maslow & Herzberg Motivation Process.

UNIT V: Perspectives of Organisation: Perception & Impression, Personality & Attitudes, Learning Values. Group Dynamics, Group formation, Group interaction, Conflict Management, Team Management ñMoraleò

UNIT VI: Leadership: Managerial styles Managerial effectiveness, Indian Manager & His effectiveness, Delegation, Decision Making.

Text Books:

1) D'Cenzo, David A., Stephen P. Robbins, and Susan L. Verhulst, *Human Resource Management,* JohnWiley and Sons, NewDelhi.

2) Keith Devis Human Behaviour at Work.

3) Kundson&Fleeror Management of Organizational Behaviour.

Reference Books:

1. Gomez-Mejia, Luis R., D. B. Balkin, and R. L. Cardy, Managing Human Resources, Prentice Hall NewJersey.
2. Ian, Beardwell, and Len Holden, Human Resource Management, Prentice Hall.
3. Dessler, Garry, Human Resource Management, Prentice Hall of India.
4. Saiyadain, Mirza S., Human Resource Management, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
5. 6. Noe, Raymond A., John R. Hollenbeck, BarryGerhart and Patrick M. Wright , Human Resource Management, Tata McGraw Hill.
6. Korman A.K. Organizational Behaviour.
7. Prasad Organization Theory & Behaviour.

6IT05 OPEN ELECTIVE II (III) INTELLECTUAL PROPERTY RIGHT

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes:

On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret,
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

UNIT I: Overview of Intellectual Property Rights:

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

UNIT II: Patents:

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

UNIT III: Copyrights:

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties ï Related Rights - Distinction between related rights and copyrights.

UNIT IV: Trademarks:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT V: Design & Geographical Indication:
Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection.
Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

UNIT VI: IPR: Current Contour: India`s New National IP Policy, 2016 ï Govt. of India step towards promoting IPR ï Govt. Schemes in IPR ï Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:
1. K. V. Nithyananda (2019), ñIntellectual Property Rights: Protection and Managementò, IN: Cengage Learning India Private Limited.
2. P. Neeraj and D. Khusdeep (2014), ñIntellectual Property Rightsò, PHI learning Private Limited.

Reference Books:
[1] Deborah E. Bouchoux, ñIntellectual Property for Paralegals ï The law of Trademarks, Copyrights, Patents & Trade secretsò, 4th Edition, Cengage learning, 2012.

[2] N. S. Gopalakrishnan and T. G. Agitha, ñPrinciples of Intellectual Propertyò, Eastern Book Company, Lucknow, 2009.

[3] M. M. S. Karki, ñIntellectual Property Rights: Basic Conceptsò, Atlantic Publishers, 2009.

[4] Ganguli Prabuddha, ñIntellectual Property Rights--Unleashing the Knowledge Economyò, Tata McGrawHill, 2001.

[5] V. K. Ahuja, ñLaw relating to Intellectual Property Rightsò. India, IN: Lexis Nexis, 2017.

[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

[7] Ajit Parulekar and Sarita DôSouza, Indian Patents Law ï Legal & Business Implications; Macmillan India ltd, 2006.

[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.

[9] Ganguli Prabuddha, ñGearing up for Patentsé The Indian Scenarioò, Universities Press,1998.

6IT06 COMPILER DESIGN LAB

Suggested List of Experiments:

Experiment No.	*EXPERIMENT DESCRIPTION*
01	Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines.
02	Write a C program to identify whether a given line is a comment or not.
03	Write a C program to recognize strings under 'a*', 'a*b+', 'abb'.
04	Write a C program to test whether a given identifier is valid or not.
05	Write a C program to simulate lexical analyzer for validating operators.
06	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
07	Write a LEX Program to scan reserved word and Identifiers of C Language.
08	Design Predictive Parser for the given language.
09	Implement SLR(1) Parsing algorithm.
10	Design a LALR bottom up parser for the given language.
11	Write a C program to generate three address codes.
12	Write a LEX Program to convert the substring abc to ABC from the given input string.
13	Write a lex program to find out total number of vowels, and consonants from the given input sting.

6IT07 DESIGN & ANALYSIS OF ALGORITHM LAB

Suggested List of Experiments:

1. To study various algorithm designing strategies.
2. Implement Multiplication algorithm using divide and conquer technique and analyze time complexity.
3. Implement Knapsack problem using greedy method
4. Implement Dijkstras Shortest Path Algorithm.
5. Implement Primôs algorithm using greedy method.
6. Implement travelling salesman problem using dynamic programming.
7. Implement search and traversal using backtracking approach.
8. To study polynomial time and non-polynomial time algorithms.

6IT08 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY & NETWORK SECURITY- LAB.

Concerned faculty member should suitably frame at least 8 laboratory assignments from the following list or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged instead of that you can add comparison between different algorithms.

Suggested List of Experiments:

1. To download various security tools which are available on Internet.
2. WAP to demonstrate any substitution stream cipher algorithm.
3. WAP to demonstrate any transposition stream cipher algorithm.
4. WAP to implement Fesital Cipher Algorithm for 8 bit data, for single round.(Assume that the session Key is 1100 & complex function ôFö be simple ôXORö.
5. WAP to demonstrate authentication using password.
6. Activation of Firewall on the system & their setting.
7. How to detect Trojans by using ï Netstat,fPort,TCPview
8. Steganography using tools: Merge Streams, image hide,Stealth Files
9. Scanning for vulnerabilities using(Angry IP,HPing2,IPSacnner)
10. Braking Mono-alphabetic Substation cipher.

6IT08 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS LAB

List of Experiments :

1. Installation of Hadoop & R
2. Building Hadoop MapReduce Application for counting frequency of words/phrase in simple text file.
3. Study of R: Declaring Variable, Expression, Function and Executing R script.
4. Creating List in R ï merging two lists, adding matrices in lists, adding vectors in list.
5. Manipulating & Processing Data in R ï merging data sets, sorting data, plotting data, managing data using matrices & data frames 4. Implementation of K-Means Clustering with R
6. Text Analysis using R: analyzing minimum three different data sets
7. Twitter Data Analysis with R
8. Sentiment Analysis of Whatsapp data with R

6IT08 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS LAB

Concerned faculty member should suitably frame at least 8 laboratory assignments from the entire syllabus or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged.

6IT09 - COMPUTER SKILL LAB IV

(# C Skill Lab IV - Mini project based on Software Engineering to be decided by Individual Dept. of respective College)

While designing a Mini Project student should follow the following steps;

1. Identifying the Requirements from Problem Statements
2. Estimation of Project Metrics
3. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
4. E-R Modeling from the Problem Statements
5. Identifying Domain Classes from the Problem Statements
6. Statechart and Activity Modeling
7. Modeling UML Class Diagrams and Sequence diagrams
8. Modeling Data Flow Diagrams
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites

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NOTIFICATION

No. 64/2022 Date : 18 /06/2022

Subject : Implementation of new Syllabi of Semester VII & VIII of B.E. (Information Technology) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum.

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester VII & VIII of B.E. (Information Technology) (C.B.C.S.) as per A.I.C.T.E. model curriculum to be implemented from the academic session 2022-23 onwards as per ñ**Appendix – A**ò as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

ñ**Appendix A**ò

Syllabus of B.E. Semester VII & VIII [(Information Technology) (CBCS)]

7IT01 MOBILE COMPUTING

Course Objectives:

1. To introduce to basic concepts of Mobile Computing and Principals of cellular communication.
2. To familiarize different components, devices for mobile computing and understand wireless application protocol.
3. Make students proficient in implementing mobile computing fundamentals using wireless scripting language.
4. To gain knowledge about open platform mobile development
5. To understand concept of distributed mobile computing.
6. Analyze different security issues in mobile computing

Course Outcomes: On completion of the course, the students will be able to-

1. Gain knowledge of basic concepts of Mobile Computing and Principals of cellular communication.
2. Understand different components, devices for mobile computing and understand wireless application protocol
3. Able to implement different concepts of mobile computing fundamentals using wireless scripting language.
4. To develop ability for developing open platform mobile development.
5. Explore concepts of distributed mobile computing
6. Identify & understand different security issues in mobile computing.

Unit I: Wireless and Mobile architecture:
Principal of cellular communication. Overview 1G,2G,3G,4G and 5G technology. GSM Architecture and Mobility management handoff management, network signaling. Mobile computing fundamental challenges, mobile device-PDA and mobile OS, Palm OS, WinCE and Symbian.

Unit II: Mobile Infrastructure and Wireless Application Protocol (WAP):
Mobile device types, components, connection method. Mobile client application, Thin client, Fat client. wireless application protocol gateways, implementing wireless enterprise wireless application protocol strategy.

Unit III: Fundamental of WML:
Writing and formatting text navigating between cards and decks, displaying images, tables using variables acquiring user input. WML Script- Control structure, events, phone.com extension and usability.

Unit IV: Building reach user interface:
Open platform for mobile development, Android SDK features, developing for mobile devices and development tools.

Unit V: Distributed Mobile Computing:
Distributed OS and file computing Mobile computing software, Pervasive computing, development strategies and tools, Data Base management for Mobile computing.

Unit VI: Security: User to mobile Client security issues, mobile client security issues, Client server communication security issues, existing web architecture and back end system security issues and case study.

Text Books:

1. UweHansmann,òPervasive computing Hand book . The mobile worldò, IEEE Publication 2002.
2. Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi.

Reference Books:

1. Yi Bing LòWireless and mobile network architectureò, John Wiley.
2. Valentino Lee; Heather Schneider; Robbie Schell, Mobile applications: Architecture, Design and development, Prentice Hall April 16 2004.
3. Retro Meler, ñProfessional Andriod application development, John wiley and sons 2010.

7 IT 02 EMBEDDED SYSTEM

Course Objectives:
Students will be expected to demonstrate their understanding of Embedded System by being able to do each of the following:
1) Introduce the fundamental and building blocks of Embedded System.
2) Impart the knowledge of basic embedded programming in various languages as well as data structures.
3) Introduce hardware units, bus communication in processors and input/output interfacing.
4) Impart knowledge of real-time operating system and various task scheduling algorithms.
5) Introduce basics of real-time operating system and case study example to elaborate importance of real-time operating system and software development tools.

Course Outcomes: On completion of the course, the students will be able to:
1) Describe the basic structural units of a processor as well as hardware units of embedded systems.
2) Explain architecture of microcontroller, and processor-memory organization for embedded system.
3) Use knowledge of programming to do embedded programming in various languages and use of data structures for programming.
4) Examine the basic concepts of operating systems with real-time operating systems aspects.
5) Assess the Real-Time Operating System programming concepts with Design examples and case studies.
6) Design embedded systems based various applications using embedded software development process and tools.

UNIT I: Introduction to Embedded Systems, Design and Development Process:

Embedded systems, Processor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, Classification of embedded systems, Skills required for an embedded system designer, Examples of embedded systems. Embedded SOC and use of VLSI circuit design technology, Complex systems design and processors, Design process in embedded system, Design challenges in embedded-system design, Hardware-software Co-Design in an embedded system, Embedded system design technologies, Design process and design examples.

UNIT II: 8051Microcontroller, Advance Processor Architectures, Processor-Memory Organization and Communication Buses:

Introduction to Microcontroller and Microprocessor, 8051 Microcontroller Architecture. Introduction to advanced processor architecture, Processor and memory organization, Processor Organization, Instruction-Level parallelism, Memory types and memory maps and addresses, Memory Hierarchy and Cache, Selection of processor and Memory devices. Serial bus communication Protocols, Parallel bus device Protocols.

UNIT III: Programming Concepts and Embedded Programming, and Program Modeling Concept:

Software programming in assembly language and in high level language óCô, óCô Program Elements: Header and Source files and Processor Directives, Macros and Functions, Data Types, Data Structures, Modifiers, Statements, Loops and Conditions, Use of Loops, Infinite Loops and Conditions, Use of Function Calls, Function Pointers and Function Queues, Queuing of Functions on Interrupts and ISR Queues, Embedded programming in C++ and Java. Program Models, DFG models, State machine programming models for event controlled program flow, modeling of multiprocessor systems, UML modelling.

UNIT IV: Basic Function of Operating Systems and Real-time Operating Systems:

Operating system services, Process management, Timer functions, Event function, memory management, Device, File, and I/O Subsystems Management, Interrupt routines in RTOS Environment and Handling of Interrupt-Source Calls, Inter process Communication and Synchronization of Process, Thread and Tasks.

Introduction to RTOS, Basic design using RTOS, RTOS task-scheduling models, OS Security Issues, OS Standards: POSIX, RTOS Interrupt Latency and Response Times of the Tasks as Performance Metrics, OS performance guidelines.

UNIT V: RTOS Programming, Design Examples and Case Studies:
Real-Time Operating Systems (RTOSes), RTOS VxWorks. Design examples and case studies: Case Study of Digital Camera, RTOS for Control Systems, Embedded system for an Adaptive Cruise Control System in a Car, Embedded system for a Smart Card, Access Control Systems (Smart Cards, RFIDs, Fingerscan).

Unit VI: Embedded Software Development Process and Tools:
Introduction to Embedded software development process and tools, Host and Target machines, Linking and Locating software, Getting embedded software into the targeting system, Issues in Hardware-Software design and Co-Design, Program-Level performance analysis and performance modeling, Testing, Simulation, and Debugging Techniques and Tools.

Text Book: Rajkamal, ñEmbedded Systems, Architecture, Programming & Designò, Third Edition TMH.

Reference Books:

1. Shibu K V ñIntroduction to Embedded Systemsò McGraw-Hill.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, ñARM Systems Developerôs Guide- Designingand Optimizing System Softwareò, 2008, Elsevier.
3. Rajkamal, ñEmbedded Systems, Architecture, Programming & Designò, Second edition, TMH.
4. Mohammad Ali Mazidi ñThe 8051 Microcontroller and Embedded System using Assembly and CòPearson.
5. Frank Vahid and Tony Givargis, ñEmbedded System Design, A Unified Hardware/Software Introductionò, John Wiley & Sons Pvt. Ltd.
6. Jane W. S. Liu, ñReal Time Systemsò, Pearson Education.
7. Tammy Noergaard ñEmbedded Systems Architectureò Elsevier Newnes Publication.

7IT06 EMBEDDED SYSTEM – LAB.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

7 IT 03 CLOUD COMPUTING

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Cloud Computing by being able to do each of the following:
1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a foundation of Cloud Computing, Cloud Computing services and tools in real life scenarios.
3. To enable student to explore some important Cloud Computing driven commercial systems and applications.
4. To provide students with essentials of Cloud Computing architecture, Virtualization, Storage and Network concepts.

Course Outcomes: On completion of the course, the students will be able to:
1. Describe the fundamental concept, architecture and applications of Cloud Computing.
2. Discuss the problems related to cloud deployment model.
3. Examine the concept of virtualization.
4. Identify the role of network connectivity in the cloud.
5. Assess different Cloud service providers.
6. Inspect the security issues in cloud service models.

Unit I: Cloud Computing Fundamental, Architecture and Management:
Computing Paradigm and various computing types, Cloud Computing Fundamentals: Motivation for Cloud Computing, The need for Cloud Computing, Defining Cloud Computing, Principles of Cloud Computing, Requirements of Cloud Services, Cloud Applications, Benefits and Drawbacks. Cloud Computing Architecture and Management: Introduction, Cloud Architecture, Network connectivity in Cloud Computing, Applications on the cloud, Managing Cloud, Migrating Application to cloud.

Unit II: Cloud Deployment and Service Models:
Cloud Deployment Models: Introduction, Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud. Cloud Service Models: Introduction, Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models.

Unit III: Operating System and Virtualization:
Types of Operating Systems, Role of OS in Cloud Computing, Features of Cloud OS. Application Environment: Need for Effective ADE, Application Development Methodologies, Cloud Application Development Platforms and Cloud Computing APIôs. Virtualization: Introduction, Virtualization Opportunities, Approaches to Virtualization, Hypervisors, Virtualization to Cloud Computing.

Unit IV: Software Development in Cloud and Networking for Cloud Computing:
Introduction, Different Perspectives on SaaS Development, New Challenges, Cloud-Aware Software Development Using PaaS Technology. Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs.

Unit V: Cloud Service Providers:
Introduction, EMC: IT, and captive cloud toolkit, Google: Platform, Storage, Cloud connect, Cloud Print and App Engine, Amazon Web Services: Elastic Compute Cloud, Simple storage, Simple Queue Service, Microsoft: Windows Azure, IBM Cloud models and IBM Smart Cloud, SAP Labs: SAP HANA Cloud Platform, Virtualization Services Salesforce: Sales Cloud and Service Cloud, Rackspace and VMware. Advances in Cloud Computing: Inter-cloud, Cloud Management, Mobile Cloud, Media Cloud, Interoperability and Standards, Cloud Governance Computational Intelligence in Cloud, Green Cloud, Cloud Analytics

Unit VI: Open Source Support for Cloud and Security in Cloud Computing:
Open Source Support for Cloud: Introduction, Open Source Tools for IaaS, Open Source Tools for PaaS, Open Source Tools for SaaS, Open Source Tools for Research, Distributed Computing Tools for Management of Distributed Systems. Security in Cloud Computing:Introduction, Security Aspects: Data, Virtualization and Network Security, Platform-Related Security: Security issues in Cloud Service Models, SaaS, PaaS, IaaS security issues, Audit and Compliance: Disaster Recovery, Privacy and Integrity.

Text Book: K. Chandrasekaran: Essentials of Cloud Computing, Edition, CRC Press Taylor & Francis Group.

Reference Books:
1. A.Shrinivasan, J.Suresh: Cloud computing a practical approach for learning and implementation, Pearson publication.
2. M.N. Rao: Cloud Computing, PHI Learning Pvt. Ltd, 2015.
3. Dr. Kumar Saurabh:Cloud computing, 2nd Edition,Wiley India 2012.
4. RajkumarBuyya, James Broberg and Andrzej M. Goscinski: Cloud Computing: Principles and Paradigms, John Wiley & Sons, Inc. 2011.
5. Anthony T.Velte , Toby J. Velteand Robert Elsenpeter, Cloud computing a practical approach, Tata McGraw-Hill , New Delhi ï 2010.
6. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, ñCloud computing for dummiesò Wiley Publishing, Inc, 2010.

7IT04 (Prof. Elect.-III) (i) MACHINE LEARNING

Course Objectives:
1. To imbibe the concepts, techniques and building blocks of machine learning.
2. To understand mathematics for modeling and evaluation.
3. To Learn various algorithms of classification & regression for supervised machine learning.
4. To Learn various algorithms of clustering for unsupervised machine learning.
5. To Introduce the concept of Reinforcement Learning.
6. To Learn the Concept of Neural network.

Course Outcomes: On completion of the course, the students will be able to:

1. Understand the concept of Machine Learning
1. Understand how to evaluate models generated from data.
2. Implement the variety of algorithms for Supervised Learning
3. Implement the variety of algorithms for Unsupervised Learning
4. Implement the variety of algorithms for Reinforcement Learning
5. Understand the concept of Neural Network

Unit I: Machine Learning: The three different types of machine learning, Introduction to the basic terminology and notations, A roadmap for building machine learning systems, Using Python for machine learning, Training Simple Machine Learning Algorithms for Classification, Artificial neurons ï a brief glimpse into the early history of machine learning, Implementing a perceptron learning algorithm in Python, Adaptive linear neurons and the convergence of learning, A Tour of Machine Learning Classifiers Using scikit-learn, Choosing a classification algorithm, First steps with scikit-learn ï training a perceptron, Modeling class probabilities via logistic regression, Maximum margin classification with support vector machines, Solving nonlinear problems using a kernel SVM, Decision tree learning, K-nearest neighbors ï a lazy learning algorithm

Unit II: Data Preprocessing, Hyperparameter Tuning: Building Good Training Sets, Dealing with missing data, Handling categorical data, Partitioning a dataset into separate training and test sets, Bringing features onto the same scale, Selecting meaningful features, Assessing feature importance with random forests, Compressing Data via Dimensionality Reduction, Unsupervised dimensionality reduction via principal component analysis, Supervised data compression via linear discriminant analysis, Using kernel principal component analysis for nonlinear mappings, Learning Best Practices for Model Evaluation and Hyperparameter Tuning, Streamlining workflows with pipelines, Using k-fold cross-validation to assess model performance, Debugging algorithms with learning and validation curves, Fine-tuning machine learning models via grid search, Looking at different performance evaluation metrics, Dealing with class imbalance

Unit III: Different Models for Ensemble Learning: Learning with ensembles, Combining classifiers via majority vote, Bagging ï building an ensemble of classifiers from bootstrap samples, Leveraging weak learners via adaptive boosting, Applying Machine Learning to Sentiment Analysis, Preparing the IMDb movie review data for text processing, Introducing the bag-of-words model, Training a logistic regression model for document classification, Working with bigger data ï online algorithms and out-of-core learning, Topic modeling with Latent Dirichlet Allocation, Embedding a Machine Learning Model into a Web Application, Serializing fitted scikit-learn estimators, Setting up an SQLite database for data storage, Developing a web application with Flask, Turning the movie review classifier into a web application, Deploying the web application to a public server

Unit IV: Regression Analysis and Clustering Analysis: Predicting Continuous Target Variables, Introducing linear regression, Exploring the Housing dataset, Implementing an ordinary least squares linear regression model, Fitting a robust regression model using RANSAC, Evaluating the performance of linear regression models, Using regularized methods for regression, Turning a linear regression model into a curve ï polynomial regression, Dealing with nonlinear relationships using random forests, Working with Unlabeled Data ï Clustering Analysis, Grouping objects by similarity using k-means, Organizing clusters as a hierarchical tree, Locating regions of high density via DBSCAN

Unit V: Multilayer Artificial Neural Network and Deep Learning: Modeling complex functions with artificial neural networks, Classifying handwritten digits, Training an artificial neural network, About the convergence in neural networks, A few last words about the neural network implementation, Parallelizing Neural Network Training with Tensor Flow, Tensor Flow and training performance, Training neural networks efficiently with high-level Tensor Flow APIs, Choosing activation functions for multilayer networks

Unit VI: CNN and RNN: The Mechanics of Tensor Flow, Key features of Tensor Flow, Tensor Flow ranks and tensors, How to get the rank and shape of a tensor, Understanding Tensor Flow's computation graphs, Placeholders in Tensor Flow, Variables in Tensor Flow, Building a regression model, Executing objects in a Tensor Flow graph using their names, Saving and restoring a model in Tensor Flow, Transforming Tensors as multidimensional data arrays, Utilizing control flow mechanics in building graphs, Visualizing the graph with Tensor Board, Classifying Images with Deep Convolutional Neural Networks, Building blocks of convolutional neural networks, Putting everything together to build a CNN, Implementing a deep convolutional neural network using Tensor Flow, Modeling Sequential Data Using Recurrent Neural Networks, Introducing sequential data, RNNs for modeling sequences, Implementing a multilayer RNN for sequence modeling in Tensor Flow, Performing sentiment analysis of IMDb movie reviews using multilayer RNNs, Implementing an RNN for character-level language modeling in Tensor Flow.

Text Book:
Sebastian Raschka, and Vahid Mirjalili ˈ Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor Flow.

Reference Books:
1. Andriy Burkov ˈ The Hundred-Page Machine Learning Book
2. Aurélien Géron ˈ Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems
3. Andreas C. Müller & Sarah Guido ˈ Introduction to Machine Learning with Python: A Guide for Data Scientists
4. Chris Albon ˈ Machine Learning with Python Cookbook: Practical Solutions from Preprocessingto Deep Learning.

7IT07 (Prof. Elect. – III) (i) MACHINE LEARNING – LAB.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

7IT04 (Prof. Elect.- III) (ii) DATA WAREHOUSING & MINING

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Data Science & Statistics by being able to do each of the following:
1. To understand the principles of Data warehousing, Architecture and Implementation.
2. To be familiar with the basic concepts of data mining and various methods for data preprocessing.
3. To study different association rules and algorithms for finding hidden and interesting patterns in data.
4. To impart the knowledge of various classification tools.
5. To understand types of data in cluster analysis and classical partitioning.
6. To understand complex data with respect to spatial and web mining.

Course Outcomes :
On completion of the course, the students will be able to:
1. Be familiar with basic concepts of Data Warehousing and OLAP operations.
2. Understand the principal of data warehousing and data preprocessing
3. Identify appropriate data mining algorithm to solve real world problems.
4. Characterize the kind of patterns that can be discovered by association rules.
5. Understand various classification and clustering technique and tools.
6. Describe complete data types with respect to spatial and web mining.

Unit I: Data Ware Housing:
Data Ware House, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation.

Unit II: Introduction to Data Mining:
Introduction to Data Mining, Data Mining Functionalities Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehousing System, Major issues in Data Mining. **Data Preprocessing**: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction.

Unit III: Patterns, Associations Rules:
Basic Concepts and Road Map: Market base analysis, frequent item sets, closed item set and association rules, frequent pattern mining. **Efficient and scalable frequent item set mining methods:**theApriori algorithm, generation association rules from frequent item sets, improving the efficiency of Apriori, Mining frequent item sets, Mining closed item sets.

Unit IV: Classification:
Problem definition, classification by decision tree induction, Bayesian classification, Rule Based classification, K-Nearest Neighbor classifiers, Kčs Based Reasoning.

Unit V: Clustering:
Problem Definition, types of data in cluster analysis, Classical partitioning: K-Means and K-Mediods methods, Hierarchical Methods, Density based Methods, Outlier Analysis.

Unit VI: Mining Object, Spatial, Multimedia, Text and Web Data:
Multidimensional Analysis and Descriptive Mining of Complex Data Objects ï Spatial Data Mining ï Multimedia Data Mining ï Text Mining ï Mining the World Wide Web.

Text Book: Jiawei Han, Micheline Kamber and Jian PeiñData Mining Concepts and Techniquesò, Second Edition.

Reference Books:

[1] Alex Berson and Stephen J. Smith ñData Warehousing, Data Mining & OLAPò, Tata McGraw ï Hill Edition, Tenth Reprint 2007.
[2] G. K. Gupta ñIntroduction to Data Mining with Case Studiesò, Easter Economy Edition, Prentice Hall of India, 2006.
[3] Pang-Ning Tan, Michael Steinbach and Vipin Kumar ñIntroduction to Data Miningò, Pearson Education, 2007.

7IT07 (Prof. Elect.- III) (ii) DATA WAREHOUSING & MINING

Minimum **Eight** experiments / programming assignments must be completed based on the syllabus covering each of the units.

7IT04 (Prof. Elect.- III) (iii) WIRELESS SENSOR NETWORKS

Course Objectives: The student should be made to:

1. To understand basic concept, challenges, building blocks and technology in WSN
2. To make capable to design WSN for given application
3. Aware with advance technology in Wireless Sensor Network
4. To understand use of routing, MAC Protocols and study
5. protocols at various layers
6. To explore knowledge about new protocols in WSN
7. To study architecture of WSNs, node and hardware
8. To understand node level software platforms
9. To study emerging field of WSN, which consist of many tiny, low power devices equipped with sensing, computation and wireless communication
10. To understand Operating Systems, Radio Communication & Networking Protocols
11. Identify the requirements for the specific applications in wireless sensor networks

Course Outcomes: At the end of the course, the students will be able to:

1. Understand basic building blocks & concepts of Wireless Sensor Networks
2. Design wireless sensor networks for a given application
3. Understand emerging research areas in the field of sensor networks
4. Understand MAC protocols used for different communication standards used in WSN
5. Explore new protocols for WSN
6. Understand architectures of Wireless Sensor Networks, its related hardware and protocols
7. Familiarized with deployment and configuration methods
8. Get acquainted to Node-level Software Platforms.

Unit I: Introduction & Overview of WSN:
Introduction to Wireless Sensor Networks, WSN Architecture, Design Issues and challenges, Characteristics of WSN, Types of wireless sensor networks, Advantages, Applications of WSNs

Unit II: Wireless Sensor Network & Technology:
Mobile Ad-hoc Networks and Wireless Sensor Networks, Architectures ofSensor Network & node, Wireless Hardware, Wireless Sensor Technology, Structure of WSN (topology), Design principles for WSNs, Service interfaces of WSNs

Unit III: Wireless Transmission Technology:
Radio Technology, Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management; Topology control, clustering protocols, transport protocols, security information assurance protocols, access control techniques, location awareness and estimation, data fusion and resource management techniques, query processing, energy efficiency

Unit IV: Protocols:
Routing protocols: Algorithms and data aggregation techniques, Routing challenges, design issues and routing strategies in WSN, Energy-efficient routing, Unicast, Broadcast and multicast geographic routing; MAC Protocols: Classification, Issues in designing MAC protocol for WSNs, IEEE 802.15.4 standard and Zig Bee; Transport Control Protocol.

Unit-V: Data Storage and Manipulation:
Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique, Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring

Unit VI Network Management, Traffic Management and OS:
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating Systems: Tiny OS, Magnet OS & Others

Text Books:

1. Kazem Sohrby, Daniel Minoli, ôWireless Sensor Networks: Technology, Protocols and Applicationsö, Wiley-Inter Science
2. Waltenegus Dargie, Christian Poellabauer, ôFundamentals of Wireless Sensor Networks Theory and Practiceö, John Wiley & Sons Publications, 2011

Reference Books:

1. SabrieSoloman, ôSensors Handbookö, McGraw Hill Publication, 2009
2. Feng Zhao, Leonidas Guibas, ôWireless Sensor Networksö, Elsevier Publications, 2004
3. Philip Levis, David Gay, ôTinyOS Programmingö, Cambridge University Press, 2009

Web References:

1. TinyOS. http://www.tinyos.net
2. https://link.springer.com/content/pdf/10.1007%2F978-3-540-30141-7_84.pdf
   (Sensor Node Architecture)

7IT07 (Prof. Elect.- III) (iii) WIRELESS SENSOR NETWORKS – LAB.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

7IT05 (Prof. Elect.- IV) (i) BLOCK-CHAIN FUNDAMENTALS

Course Pre-requisite: Knowledge of Computer Network and Network Analysis & Security.

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Blockchain Technology by being able to do each of the following:

1. To understand Blockchainös fundamental components, and examine decentralization using blockchain.
2. To explain how cryptocurrency works, from when a transaction is created to when it is considered part of the Blockchain.
3. To explain the components of Ethereum and Programming Languages for Ethereum.
4. To study the basics of Hyperledger and Web3.
5. To know about alternative Blockchains and Blockchain projects in different domains.

Course Outcomes: On completion of the course, the students will be able to:

1. Understand the technology components of Blockchain and how it works behind the scenes.
2. Identify different approaches to developing decentralized applications.
3. Understand Bitcoin and its limitations by comparing with other alternative coins.
4. Devise solution using the Ethereum model.
5. Understand and use Hyperledger and its development framework.
6. Track alternative Blockchains and emerging trends in Blockchain.

Unit I: Introduction To Blockchain:
History of Blockchain ï Types of Blockchain ï Consensus ï Decentralization using Blockchain ï Blockchain and Full Ecosystem Decentralization ï Platforms for Decentralization.

Unit II: Introduction To Crypto currency:
Bitcoin ï Digital Keys and Addresses ï Transactions ï Miningï Bitcoin Networks and Payments ï Wallets

Unit III: Alternative Coins & Smart Contract:
Alternative Coins ï Theoretical foundations ï Bitcoin limitations ï Smart Contracts ï Ricardian Contracts.

Unit IV: Ethereum:
The Ethereum Network ï Components of Ethereum Ecosystem ï Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule ï Supporting Protocols ï Solidity Language.

Unit V: Web3 & Hyperledger:
Introduction to Web3 ï Contract Deployment ï POST Requests ï Development Frameworks **Hyperledger as a Protocol** ï The Reference Architecture ï Hyperledger Fabric ï Distributed Ledger ï Corda.

Unit VI: Alternative Blockchains And Next Emerging Trends:
Kadena ï Ripple ï Rootstock ï Quorum ï Tendermint ï Scalability ï Privacy ï Other Challenges.

Text Book: Imran Bashir, ñMastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explainedò, Second Edition, Packt Publishing, 2018.

Reference Books:

1. ArshdeepBahga, Vijay Madisetti, ñBlockchain Applications: A Hands on Approachò, VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, ñMastering Bitcoinò, OôReilly, 2014.
3. Roger Wattenhofer, ñThe Science of the Blockchainò Create Space Independent Publishing, 2016.

7IT08 (PE-III) (i) BLOCK-CHAIN FUNDAMENTALS

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

7IT05 (ii) BUSINESS INTELLIGENCE

Course Objectives: With this course the students should be able:

- To be able to formulate and understand the business problem and provide analytical solution for the same
- To be able to understand the various methods of finding proper required data and mining of appropriate contents
- To be able to use of the data science concepts in business decision making
- To be able to represent the complete Business Case in the form of Dashboards and presentation that are understandable by all stakeholders

Course Outcomes:

After the successful completion of this course the students will be able:

- To obtain sound knowledge of the theory and concepts that are required for a Business Intelligent System.
- To understand the various business problems and design various models that help in making business decisions.
- To understand and implement the mathematical concepts to develop data centric decision models.
- To generate various dashboards that will help explain the Business Problem to stakeholders at different levels of the business process.

Unit I: Overview of Business Intelligence, Analytics and Data Science: Changing business environments and evolving needs for decision support and Analytics, Evolution of Computerized Decision Support, Framework for BI, Analytics Overview, Analytics example from different domains, Introduction to Big Data analytics, overview of analytical ecosystems

Unit II: Data Modelling and Visualization: Nature of Data, Art and Science of Data Pre-processing, Statistical Modelling for Business Analytics, Regression Modelling for Inferential Statistics, Business Reporting, Data Visualization, Different types of Charts and Graphs, The Emergence of Visual Analytics, Dashboards Designing and Best Practices for Dashboards Designing

Unit III: ANALYTICS: Analytics concepts and use in Business Intelligence, Exploratory and statistical techniques: - Cluster analysis, Data visualization, Predictive analysis: - Regression, Time series, Data Mining: - Hierarchical clustering, Decision tree Text analytics: - Text mining, In-Memory Analytics and In-DB Analytics, Case study: Google Analytics

Unit IV: Business Intelligence and Data Warehousing: Star schema, Snow flake schema, and Fact Constellation schema, Grain of dimensional model, transactions, Recurring Snapshots, Accumulating Snapshots, Dimensions (SCD types, conformed dimensions) Clickstream Source Data (Google Analytics as a Clickstream Data Source), Facts (additive, semi-additive, non-additive), Hierarchy in dimensions, parent child relationships, Many-Many Dimensional relationship, Multi Valued Dimensions and Dimension Attributes

Unit V: ETL: Data Quality, Data profiling, Data enrichment, data duplication, ETL Architecture and what is ETL, Extraction concept and Change data capture, Transformation concept, lookups, time lag, formats, consistency, loading concept, Initial and Incremental loading, late arriving facts, what is Staging, Data marts, Cubes, Scheduling and dependency matrix.

Unit VI: Future Trends, Privacy in Analytics: IoT, Issues in Legality, Privacy and Ethic, Could Computing and Business Analytics, Location based analytics for Organizations, Impact of Analytics on Organizations.

Text Books:
1. Turban E., Sharda R., Delen D., King D., Business Intelligence, Analytics and Data Science Pearson Edn., 4e
2. Efrem G. Mallach, ñDecision Support and Data Warehouse Systemsò, 1st Edition Publisher: Tata McGraw-Hill Education

Reference Books:

1. ReemaThareja, ñData Warehouseò, Publisher: Oxford University Press
2. Jiawei Han, Micheline Kamber, Jian Pei ñData Mining: concepts and techniquesò, 2nd Edition, Publisher: Elsevier/Morgan Kaufmann
3. Dorian Pyle, ñBusiness Modeling and Data Miningò, Elsevier Publication MK.

7IT08 (PE-III) (ii) BUSINESS INTELLIGENCE- LAB.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

7IT05 (PE-IV) (iii) DIGITAL FORENSIC

Course Prerequisite: Cryptography and Security, Computer Networks

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of digital security by being able to do each of the following:

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.

Course Outcomes: On completion of the course learner will be able to-

- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- To be well-trained as next-generation computer crime investigators.
- Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.
- Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.
- Apply the knowledge of IDS to secure network and performing router and network analysis
- List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools .

Unit I: Introduction Computer Forensic:

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Unit II: Computing Investigations:

Understanding Computing Investigations ï Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Unit III: Data Acquisition and Process:

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Unit IV: Mobile Phone HCI:

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Unit V: Computer Forensic Tools:

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Unit VI: Study of Report:

Forensic Investigation Report: Goals of Report, Layout of an Report and Forensic Tools Investigative Report, Guidelines for Writing a Report, sample for writing a forensic report . Computer Forensic Tools : need and types of computer forensic tools, task performed by computer forensic tools.

Text Books:

1. Warren G. Kruse II and Jay G. Heiser, ñComputer Forensics: Incident Response Essentialsò, Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., ñGuide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

Reference Book:

Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

7IT08 (PE-III) (iii) DIGITAL FORENSIC- Lab.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

7IT09 PROJECT & SEMINAR

Students should complete the following:

Literature Review
Problem scope
Problem Definition
Requirement Analysis
Methodology to solve problem
Preliminary Implementation
Preliminary Results.

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8IT01 OBJECT ORIENTED ANALYSIS AND DESIGN

Course Prerequisite:

1. Students should have knowledge of object oriented concepts
2. Students should have knowledge of Software Development Life Cycle.

Course Objectives:

1. To understand concept of Object oriented modeling.
2. To analyses the concept of Unified Modeling Language (UML) for representation of an object-oriented system.
3. To learn software development using Object oriented approach.

Unit I: Modeling Concept: Introduction, Object orientation, OO Development, OO themes, Modeling as a design technique, Class Modeling. Abstraction, The three models, Object and class concepts, Link and association concepts, Generalization & Inheritance, Navigation of class models.

Unit II: Advanced Class Modeling: Advanced object and class concepts, Association Ends, N-ary association, Aggregation, Abstract classes, Multiple inheritance, Metadata, Reification, Constraints, Derived data, Packages, State Modeling: Events, States, Transitions and Conditions, State diagrams, State diagram behavior.

Unit III: Advanced State Modeling: Nested state diagram, Signal Generalization, Nested states, Concurrency, Relation of class and state models, Use case model, Sequence models, Activity models, Use case relationships, Procedural sequence model, Special constructs for activity models.

Unit IV: Domain Analysis: Development stages, Development life cycle, Devising a system concepts, Elaborating a concepts, Preparing a problem statements, Overview of analysis, Domain class models, Domain state model, Domain Interaction model.

Unit V: Application Analysis: Application Analysis. Overview of System Design, Estimating Performance, Making a reuse plan, Breaking a system into subsystems, Identifying Concurrency, Allocation of subsystems, Management of data storage, Handling global resources, Choosing a software control strategy, Handling boundary conditions, Setting trade-off priorities, Architecture of the ATM system.

Unit VI: Class Design: Overview of class design, Realizing the use cases, Designing algorithm, Recurring Downwards, Refactoring, Design Optimization, Reification of behavior, Adjustment of Inheritance, Organizing a class design.

Text Book: Blaha, Rumbaugh,òObject Oriented Modeling and Design with UMLò (2/e) Pearson Education.

Reference Books:

1. Dathan, Ramnath: ñObject Oriented Analysis, Design & Implementation,ò OUP.
2. McRobb & Farmer: ñObject Oriented System Analysis & Designò McGraw Hill.
3. Booch, Rumbaugh & Jacobson: ñThe UML User guideò Pearson Education.
4. Whitten & Bentley: ñSystem Analysis & Design Methodsò Tata McGraw Hill.
5. Booch: ñObject Oriented Analysis & Design with Applicationsò, Pearson Education.

8IT05 Object Oriented Analysis & Design – Lab.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

8IT02 PROFESSIONAL ETHICS AND MANAGEMENT

Course Objectives:

1. To enable the students to create an awareness of engineering and professional ethics
2. To instill moral, social values and appreciate the rights of others
3. To regulate the studentøs behavior in a professional environment
4. To conscious about the impact of non-ethical engineering decisions
5. To comprehend ómind and desire controlô needs for being ethical
6. To understand the moral values of óengineering professional ethicsô
7. To resolve the moral problems and issues in engineering
8. To learn the duty & responsibility towards society and environment
9. To be aware with code of conduct and code of ethics.

Course Outcomes:

1. Ability to Distinguish between ethical and non ethical situations
2. The student should be able to apply engineering ethics in the society & environment
3. Infer the moral judgment & correlate the concepts in addressing the ethical dilemmas
4. Resolve the moral issues in the profession
5. Relate the code of ethics to social experimentation
6. Able to apply risk and safety measures in various engineering fields
7. Develop concepts based on moral issues and enquiry
8. Discuss ethical issues related to engineering & realize the responsibilities and rights
9. Develop cognitive skills in solving social problems.

Unit I: Introduction to Ethics: Senses of Engineering and professional ethics**,** Engineering profession& its view, Ethical issues for engineers, distinction between ethics, morals and laws, opinions vs. judgments, Ethical theories: utilitarianism, duty, right, virtue; Cost-benefit analysis in engineering, McCuenøs ethical dimensions, IEEE: Code of conducts & Code of ethics.

Unit II: Professional Practices in Engineering: Professional attributes, Difference in engineering and other professions; Ethical dilemma: right-wrong or better-worse; Code of ethics for engineers in India: need and its roles; abuse of codes, ethical relativism, well-being and profession, Ethics as Design **-** Doing Justice to Moral Problems, Kohlbergøs theory ï Gilliganøs theory

Unit III: Central Professional Responsibilities of Engineers: Confidentiality and Proprietary Information, Conflict of interest, Competitive bidding, rights of Engineers: fundamental, professional conscience, conscientious refusal, professional recognition, employee, privacy; types of conflict of interest, avoiding conflict of interest, competitive bidding, situations for conflict of interest, ethical corporate climate & its features

Unit IV: Intellectual Property Rights and Ethics: Patent: IP chain of activities, IP as intangible property, protection offered by patent, right of patent owner; Trademarks(TM): purpose, what can be registered under trademark, categories of TM, industrial design, geographical indications; Copyright & related rights: advances in technology and copyright, benefits, World IP organization, TRIPS& WTO

Unit V: Computers, Software and Digital Information: Emergence of Computer ethics, issues in Computer ethics: distribution of power issues, property issues, issues of privacy, professional issues, Computer crimes, Computer Software and Digital Information: Characteristics of digital information**,** s/w as IP, and challenges in information age, IEEE code of conduct and code of ethics

Unit VI: Responsibilities and Management: Responsibility for the Environment, Engineering as Social Experimentation, Safety and Risk management, IT Professional relationship management with: Employers, Clients, Suppliers, IT Users, other professionals, and society at large

Text Books:

1. Prof. SusmitaMukhopadhyay, õEthics in Engineering Practiceö IIT Kharagpur
2. Mike Martin and Roland Schinzinger, õEthics in Engineeringö, Tata McGraw Hill, New York, 2005

Reference Books:

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, õEngineering Ethics ï Concepts and Casesö, Cengage Learning, 2009 & Thompson Learning, 2000
2. Govindarajan M., Natarajan,õEngineering Ethicsö, Prentice Hall of India, New Delhi, 2004
3. Stephen Byars, õBusiness Ethicsö,USC Marshal School of Business Kurt Stanberry, University of Houston*(https://openstax.org/details/books/business-ethics)*

Web Resources:

1. https://nptel.ac.in/courses/110/105/110105097/
2. www.nspe.org
3. https://www.global-ethic.org/global-ethic-institute/
4. www.ethics.org
5. https://er.educause.edu/articles/2017/3/ethics-and-the-it-professional
6. https://www.ieee.org/about/corporate/governance/p7-8.html
7. https://www.ieee.org/about/compliance.html.

8IT03: PROJECT MANAGEMENT & ENTREPRENEURSHIP

Course Objectives:
1. Gain knowledge of a broad range of topics related to entrepreneurship and entrepreneurial strategies
2. Gain knowledge on entrepreneurial potential as an individual
3. Gain knowledge on discovering opportunities
4. Gain knowledge on business models

Course Outcomes:
1. Gain knowledge on opportunities / ideas screening
2. Gain knowledge on basic entrepreneurial issues Develop critical thinking skills to solve real life Entrepreneurship and SME problems
3. Develop critical thinking skills to solve real life Entrepreneurship and SME problems
4. Develop critical thinking skills on developing a career as entrepreneurs

Unit I: Entrepreneurship: Entrepreneurship: need, scope, Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (McClellendôs Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes.

Unit II: Entrepreneurial Idea and Innovation: Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness 8

Unit III: Project Management: Project management: meaning, scope & importance, role of project manager project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal,; Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.

Unit IV: Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.

Unit V: Management of Enterprises Objectives and functions of management, scientific management, general and strategic management; introduction to human resource management: planning, job analysis, training, recruitment and selection, etc.; marketing and organizational dimension of enterprises; enterprise financing : raising and managing capital, shares, debentures and bonds, cost of capital; break- even analysis, balance sheet its analysis.

UnitVI: Social Entrepreneurship: Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.

Text Books:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas

Reference Books:

1. Entrepreneurship: Roy Rajeev; OUP.
2. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
3. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn,H.PHI
4. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

8IT04 (Prof.Elect.-V) (i) ROBOTICS

Course Prerequisite: Knowledge of Real Time Embedded System and Artificial Intelligence.

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of the following:

1. To understand the functions of the basic components of a Robot.
2. To study the use of various types of End of Effectors and Sensors
3. To impart knowledge in Robot Kinematics and Programming.
4. To learn Robot safety issues and economics.

Course Outcomes : On completion of the course, the students will be able to:
1. Be familiar with basic concepts of Robot.
2. Understand the use of various types of End of Effectors and Sensors
3. Get appropriate knowledge in Robot Kinematics and Programming.
4. Understand the Robot safety issues and economics.

Unit I: Fundamentals of Robot:
Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification-Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

Unit II: Robot Drive Systems and End Effectors:
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

Unit III: Sensors and Machine Vision:
Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques.

Unit IV: Robot Kinematics:
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design.

Unit V: Robot Programming: Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.
Unit VI: Implementation and Robot Economics:
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Text Books:
1. Klafter R.D., Chmielewski T.A and Negin M., ñRobotic Engineering - An Integrated Approachò, Prentice Hall, 2003.
2. Groover M.P., ñIndustrial Robotics -Technology Programming and Applicationsò, McGraw Hill, 2001.

Reference Books:
1. Craig J.J., ñIntroduction to Robotics Mechanics and Controlò, Pearson Education, 2008.
2. Deb S.R., ñRobotics Technology and Flexible Automationò Tata McGraw Hill Book Co., 1994.
3. Koren Y., ñRobotics for Engineers", McGraw Hill Book Co., 1992
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., ñRobotics Control, Sensing, Vision and Intelligenceò, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., ñRobotics and Image Processingò, Tata McGraw Hill, 1995.
6. Rajput R.K., ñRobotics and Industrial Automationò, S.Chand and Company, 2008.
7. Surender Kumar, ñIndustrial Robots and Computer Integrated Manufacturingò, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

8IT06 ROBOTICS – Lab.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

8IT04 (Prof.Elect.-V) (ii) VIRTUAL AND AUGMENTED REALITY

Course Pre-requisite: Fundamental mathematics knowledge:

Course Objectives:
The objective of this course is to provide a foundation to the fast growing field of virtual and augmented reality and make the students aware of its applications.

Course Outcomes: On completion of the course, the students will be able to:
1. Understand basic concepts of virtual reality with its applications.
2. Understand and describe computing architectures, hardware and software needed for virtual reality.
3. Learn the basic knowledge of augmented reality.
4. Understand and analyze hardware and software needed for augmented reality.
5. Understand the knowledge about various applications of augmented reality.

Unit I: Introduction of Virtual Reality Hours:
Defining Virtual Reality, History of Virtual Reality, Human Physiology and Perception, Five Classic components of VR, Applications of VR.

Unit II: Input and Output Devices for Virtual Reality:
Three dimensional position tracker and mechanical tracker, Navigation and manipulation Interfaces, Gesture Interfaces, Graphic displays, Sound Displays and Human Haptic System.

Unit III: Virtual Reality Computing Architectures:
Rendering Pipeline, Graphics Rendering Pipeline,Haptic Rendering Pipeline, PCGraphicsArchitecture,Workstation Based Architectures and Distributed VR Architectures.

Unit IV: Introduction to Augmented Reality:
Defining Augmented reality, History of augmented reality, The Relationship Between Augmented Reality and Other Technologies- Media. components of VR, Applications of VR.

Unit V: Augmented Reality Hardware and software: Major Hardware Components for AR System:- Overview of Sensor, Processor and Display. Major Software Components for AR System:-Software or editing and creating 2D and 3D Graphics. components of VR, Applications of VR.

Unit VI: Augmented Reality Applications:
Define: Content, Introduction to Mobile Augmented Reality with its advantages and its disadvantages, Application Areas, Future and trends of Augmented Reality.

Text Books:
1. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley 2016.
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications" Morgan Kaufmann, 2013.

Reference Books:
1. "Virtual Reality", Steven M. LaValle, Cambridge University Press, 2016.
2. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications :Foundations of Effective Design", Morgan Kaufmann, 2009.
3. John Vince, ñVirtual Reality Systems ñ, Pearson Education Asia, 2007.
4. Anand R., ñAugmented and Virtual Realityò, Khanna Publishing House, Delhi.

8IT06 Virtual and Augmented reality Lab:

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

8IT04 (Prof.Elect.-V) (ii) HUMAN COMPUTER INTERACTION

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Human Computer Interaction by being able to do each of the following:

- To understand the fundamental concepts of Human Computer Interaction.
- To familiarize the students with basic taxonomy and terminology of HCI.
- To understand various model based designs and research methods in HCI.
- To design the effective web interface and evaluate the various design case studies.

Course Outcomes: On completion of the course learner will be able to:
1. Understand the principles and fundamental concept of Human Computer Interaction.
2. To learn Model based designs and graphical user interfaces in HCI.
3. Evaluate various research methods and task modeling analysis in HCI.
4. Design effective HCI for mobile phone interface.
5. Explore the HCI implications for designing multimedia/ ecommerce/e-learning Web sites.
6. To Understand Cognitive Architecture and Evaluate the design case studies.

Unit I: Introduction:
Human factors of interactive software: Goals of system engineering & User-interface design, accommodation of human diversity, Shneidermanôs eight golden rules of interface design, The three pillars of design, Intractive System Design: Concept of usability: definition and elaboration, GUI design and aesthetics, Prototyping techniques.

Unit II: Model-based design in HCI:
Introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Cognitive Models, Communication and collaboration models: Multimedia and WWW, Object-Action interface model, Normanôs Model of Interaction.

Unit III: Research Methods and Task Modeling in HCI:
Imperical Research Methods: Introduction, motivation, issues, research questions formulation Task Modeling and Analysis: Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT)

Unit IV: Mobile Phone HCI:
Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Software Tools.

Unit V: Web Interaction Design:
Multiple window strategies, Computer supported cooperative work: Goals of cooperation, Asynchronous interaction, Synchronous distributed and face-to-face, Information search and visualization, Database Query and phrase search in textual documents, multimedia documents searches, Web Interface Design: Hypermedia and the World Wide Web, designer goals, Users and their tasks, Object action interface model for web site design.

Unit VI: Cognitive Architecture and HCI:
Introduction to Cognititve Architecture, Cognititve Architecture types, relevance of Cognititve Architecture in interface design. OOM-Object Oriented Modeling of User Interface Design, Design Case Studies.

Text Books:

1. B. Shneiderman; *Designing the User Interface*, Addison Wesley 2000 (Indian Reprint).
2. Dix A., Finlay J., Abowd G. D. and Beale R. *Human Computer Interaction*, 3rd edition, Pearson Education, 2005.

Reference Books:

1. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
2. Brian Fling, Mobile Design and Development, First Edition, O‟Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, Designing Web Interfaces‟, First Edition, O‟Reilly, 2009.

8IT06 Human Computer Interaction - Lab.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

8IT04 (Prof. Elect.-V) (iv) CROSS-PLATFORM DEVELOPMENT

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of the following:

1. To understand the different cross platform mobile application development tools.
2. To understand various Object-oriented programming concepts.
3. To study and understand flutter framework for building beautiful, natively compiled, multi-platform applications from a single codebase.
4. To impart knowledge in development of packages and widgets.
5. To learn layout management in widget.
6. To design and develop cross platform application.

Course Outcomes: On completion of the course, the students will be able to:

1. Be familiar with different cross platform mobile application development tools.
2. Get appropriate knowledge of Object-oriented programming concepts.
3. Learn fundamental concepts of flutter.
4. Declare and construct UI.
5. Understand layout management in widget.
6. Design and develop cross platform application

Unit I: Introduction: Before Cross-Platform Mobile Application Development, Early Cross-Platform Development Tools, Development Tools That Used Native Libraries, Development Tools That Didn‟t Use Native Libraries, Modern Cross-Platform Development Tools, React Native, Google Flutter, Introduction to Dart, Platforms, Dart SDK, Command-Line Tools, Libraries, Introduction to Typing, Dart Typing, Static Types, Dynamic Types (aka Untyped), Type Inference, Type Matching, Type Information, Strings, Object-Orientated Language Features

Unit II: More Advanced Dart: Operator Overloading, Reflection, Mixins, Collections, Assertions, Assertions & Modes (Flutter), Errors & Exceptions, Handling Errors, Handling Exceptions, Console Output, Asynchronicity, Reactive Programming.

Unit III: Introduction to Flutter: What is Flutter?, Fuschsia, Flutter Source Code, Flutter SDK, Installing Flutter, Issues, Install Process, Your First App, Default Flutter App, Generate Your First App, Emulators, Open Android Emulator & Run Your First App, Open iOS Emulator & Run Your First App, Connect Your Device & Run Your First App, Hot Restarting & Reloading

Unit IV: Dependencies, Packages & Widgets: Website, Core Packages, Non-Core Packages, Most Useful Non-Core Packages, How to Use an External Package, Package Version Numbers, Project Files, How to Publish Your Own Packages, Default Flutter Application Project, Introduction to Widgets, User Interface: Material & Cupertino, User Interface: Cupertino, Building Widgets, Widgets Have No Mutable State, Stateless Widgets, Minimum Code, Creation, Rendering, Lifecycle, Stateful Widgets, Minimum Code, Two Classes, Creation, Rendering, LifeCycle Methods, Basic Material Widgets, Text, Image, Icon, Buttons.

Unit V: Multi-Child Layout Widgets, Column, Row, Flex, List View, Stack, Single-Child Layout Widgets, Padding, Container, Card, Expanded, Flexible, Center, Gesture Detector, Positioned, Safe Area, Single Child Scroll View, App Scaffolding Widgets, Material App, Scaffold, App Bar, Body, Bottom Navigation Bar, Drawer, Bottom Sheet, Persistent Footer Buttons, Checkbox, Dialog, Dropdown Button & Dropdown Menu Item, Expansion Panel List & Expansion Panel, Grid View, Popup Menu Button, Radio, Snack Bar, Spacer, Switch, Tab Bar, Tabs and Tab Bar View Widgets, Table.

Unit VI: Complete Cross-Platform Applications: Builders, Routing & Navigation, Forms, HTTP, APIs, REST & JSON, Flutter with HTTP, APIs, REST & JSON, State, State & Stateful Widget Approach, State & Inherited Widget Approach, State & Scope d-Model Approach, State & BLoCs w/Streams Approach, Local Persistence, Mixins, Debugging & Performance Profiling, Change Detection, Keys & Rendering, Other Performance Considerations, Publishing Your App

Text Book: Mark Clow ˈ Learn Google Flutter Fast 65 Example Apps.

Reference Books:

1. Marco L. Napoli ˈ Beginning Flutter: a hands on guide to app development
2. Frank Zammetti ˈ Practical Flutter: Improve your Mobile Development with Googleȇs Latest Open-Source SDK
3. Simone Alessandria ˈ Flutter Projects: A practical, project-based guide to building real-world cross-platform mobile applications and games
4. Prajyot Mainkar Salvatore Giordano ˈ Google Flutter Mobile Development Quick Start Guide.

8IT06 (Prof. Elect.-V) (iv) Cross Platform Application Development – Lab.

Minimum **Eight** experiments/programming assignments must be completed based on the syllabus covering each of the units.

Suggested List of Experiments:

1. Install Dart and set the environment of Flutter SDK.
2. Write a program to display ñHello Worldò
3. Write a program to create your own stateless widgets
4. Write a program to use different fields like text field, button etc..using flutter
5. Write a program on Form widget
6. Write a program on Validate only after submit attempt
7. Write a program to use Custom gestures for your custom widgets
8. Write a program App Bar widget
9. Write a program to apply the layout and animation on your own Application
10. Write a program to implement the firebase in your own application

8IT07 PROJECT & SEMINAR

Course Objectives:

1) To work in a team in a planned manner on a chosen engineering topic based on the knowledge gained throughout the engineering programme.
2) Major project should be real time and research based problems based on the courses studied.
3) Project to be completed with detailed design, implementation, test case preparations, testing and demonstration
4) It is having Group formation, discussion with faculty advisor, formation of the project statement, resource requirement, identification and implementation and Time scheduling of the project.
5) Continuous assessment for the activities mentioned has been carried out throughout the semester.
6) The student should prepare a consolidated report in LaTeX /word and submit it before term end.
7) Project consists of presentation and oral examination based upon the project work demonstration of the fabricated/designed equipment or software developed for simulation. The said examination will be conducted by a panel of examiners, consisting of preferably guide working as internal examiners and another external examiner preferably from an industry or university.

Course Outcomes:

1) Design solutions for given engineering problem.
2) Demonstrate practical knowledge by constructing models/algorithms for real time applications.
3) Express effectively in written and oral communication.
4) Exhibit the skills to work in a team.
5) Prepare a time chart and financial record for execution of the project.
6) Personal competences of students are reinforced most during the Final Year Project process, including the preparation, elaboration, presentation and defense stage.
7) Final Year Projects represent the culmination of study towards the Bachelor of Engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. Assessment is by means of a seminar presentation, submission of a thesis, and a public demonstration of work undertaken.

List of thrust areas: #

1. Control
2. Sensor
3. Embedded
4. Automotive
5. Automation (PLC, SCADA)
6. Process Instrumentation
7. Healthcare
8. Signal Processing
9. Image processing
10. Artificial Intelligence
11. IoT
12. Application Software development

 # Please note that the above list is an indicative list (not an exhaustive) and students are free to select project areas other than the list.

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B.E./B.Arch./B.Text.E./B.Tech. Prospectus No. 121712
III & IV Semester

संत गाडगे बाबा अमरावती विद्यापीठ

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SYLLABI PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF ENGINEERING
PRODUCTION ENGINEERING
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 PE 01 / 3 CH 01 MATHEMATICS-III / APPLIED MATHEMATICS-III

1. Prerequisite of Subject
   Engineering mathematics I and
   Engineering mathematics II
2 Objectives of Applied mathematics III. On Completion of the students are expected.
   - To understand Fourier transform & Z-transform, Laplace transform & their application to engineering problems.
   - To know probability and probability distribution.
   - To understand Numerical analysis.
   - To know vector Clarks &their application.

SECTION-A

UNIT –I: Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7 Hrs.)

UNIT-II: Laplace transforms: Definition, standard forms, properties of Laplace transform, Inverse Laplace transform, Laplace convolution theorem, Laplace transforms and Unit step function, Solution of Linear differential equations. (7 Hrs.)

UNIT-III: Probability & Probability Distribution
Probability : definition, axioms of mathematical probability, complementation rule, Theorem of total probability, Theorem of compound probability, Independent Events, subjective probability, Baye's Theorem, Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (7 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :-
Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic conjugate functions, Milne's method, singular points, expansion of function in Taylor's and Laurent's series, Cauchy's integral theorem and formula, Residue theorem. (7Hrs.)

UNIT-V: Numerical Analysis:
Solution of algebric and transcendental equations by method & method of false position, Newton-Raphson method Solution of system of linear equations by Gauss Seidal method, Relaxation method. Solution of first order ordinary differential equations by modified Euler's, method Runge - Kutta method. (7Hrs.)

UNIT-VI: Vector Calculus :-
Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (7Hrs.)

OUTCOMES:

Students are expected to expertise in solving numerical methods, Laplace transform, Fourier Transform & Z-transform

Probability & Probability Distribution and statistics are very useful to them in future curriculum/student.

Complex functions and vector calculus are backbone of future academic curriculum and hence should be in tuch with contents in syllabus.

Design of syllabus is more than sufficient for academic curriculum of student.

Text Books:

1. Higher Engineering. Mathematics by B.S. Grewal, Khanna Publication.
2. A Text Book of Applied Mathematics, Volume-II by P. N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference books:

1. Numerical Analysis- S.S. Sastry.
2. Advancing Engg. Mathematics by E.K.Kreyzig.

3PE02 / 3ME02 STRENGTH OF MATERIALS / MECHANICS OF MATERIALS

SECTION-A

Unit-I
1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety.
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II
1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs.

Unit-III
1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin and thick cylinders and thin spherical shells subjected to internal pressures.

Unit –V :
1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.

2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI : Deflection of beams
Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books :

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Materials, Danpat Rai and Sons, New Delhi.

Reference Books :

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New
Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material : A Practical Approach, I ed, University Press, Hydrabad.

3PE03 FLUID POWER SYSTEMS

Lecture:03 Hrs/ w		Internal Assessments:	20
Tutorial:—		University Exam:	80
		Credits:	03

Course Objectives:

- To understand concept of fluid mechanics, fluid types, fluid flow.
- To understand different equipment for measurement of flow of fluid.
- To understand different Pumps, Valves and Hydraulic Machineries.

SECTION-A

UNIT- I : Introduction to study of fluid motion, different properties of fluid, fluid pressure and its measurement, hydrostatic on plane and curved surfaces. (6)

UNIT- II : Fundamentals of fluid flow, types of fluid flow, continuity equation, equation of motion and energy equation, forces acting on fluid in motion, Euler's equation and Bernoulli's equation, flow through pipes and its losses, losses in fittings (8)

UNIT- III : Application of Bernoulli's equation to venture meter, nozzle meter etc. pitot tube theory and application. Introduction to laminar and turbulent flow, Reynolds number and its significance, Flow through notches and orifice and flow measuring devices. (8)

SECTION-B

UNIT- IV : Pumps: Basic theory, working Principle and characteristics of variable capacity and fixed capacity type pumps, gear, vane, piston, rotary and axial piston pumps, Reciprocating pumps. (7)

UNIT- V : Valves: Check Valve, Operation and Selection, pressure relief valve principal types, speed and pressure valves, Differential pressure control valves, simple hydraulic circuit using these components.
(8)

UNIT- VI : Hydraulic systems:

1. Function and application of Hydraulic accumulation, differential hydraulic accumulator, intensifier, ram, lift riveter and crane.
2. Hydro Kinetic system such as fluid coupling and torque convertors.
3. Fluid, drives for machine tools such as lathe, drilling machine and shaper. (8)

TEXT BOOKS:

1. A TEXTBOOK OF FLUID MECHANICS AND HYDRAULIC MACHINES By: Dr. R. K. Bansal, 19(2010), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131808153.
2. INTRODUCTION TO FLUID MECHANICS (SI EDITION) ,Edward J. Shaughnessy,Jr, Ira M. Katz, and James P. Schaffer , 2005, Oxford University Press ,ISBN: 9780195677836.
3. INTRODUCTION TO FLUID MECHANICS AND FLUID MACHINES, By: S Som,G Biswas, Edition: 2 (2007), Tata McGraw-Hill Education, ISBN: 9780070667624.

REFERENCE BOOKS:

1. FLUID MECHANICS AND HYDRAULIC MACHINES, By: S. C. Gupta ,2006 Pearson Education, DELHI, INDIA, ISBN: 9788177583649.

2. HYDRAULIC FLUID MECHANICS AND FLUID MACHINES , By: S. Ramamrutham , Dhanpat Rai Publishing Company (P) Ltd, 1980, Dhanpat Rai Publishing Co. (P) Ltd, ISBN: 8187433841
3. ENGINEERING FLUID MECHANICS, By: Balachandran, P., PHI Learning Private Limited, Delhi. ISBN: 9788120340725
4. FLUID MECHANICS AND HYDRAULIC MACHINES, By: S.S. Rattan, Khanna Books Publishing Co (P) Ltd, New Delhi. ISBN: 9788187522461
5. Fluid Mechanics & Hydraulic Machines, By R.K.Rajput, 04 (2002), S.Chand & Company Limited, New Delhi, ISBN: 8121916666.

3PE04 THERMAL POWER ENGINEERING

Lecture: 03 Hrs/ w	Internal Assessments: 20
Tutorial: 01 Hr/ w	University Exam: 80
	Credits: 04

Course Objectives:

- To understand the fundamentals of various thermodynamic devices
- To analyze the performance and understand the applications of thermodynamic systems
- To understand applications and working of Boilers and Steam Engines, IC engines , Air compressors, Steam Turbine, Gas Turbine and Heat Transfer.

SECTION-A

UNIT- I : **Basic Concepts** - Thermodynamic systems, control volume, properties and state of a system. Point and path function, processes and cycles, difference between work and heat, Ideal gases and vapours, ideal gases, as laws, equation of state, gas constant. Universal gas constant.
(6)

UNIT- II : **Lows of thermodynamics :** Low of conservation of mass & energy, lows of thermodynamics, work done, change in internal energy & Heat transfer during non-flow Processes. Introduction to entropy.
(8)

UNIT-III: **Properties of steam :** Triple point, critical point, sensible heat, latent heat, superheat & total heat of steam. Sp. Volume, internal energy, external work of evaporation , dryness fraction & its determination, entropy of steam.

Boilers: Classifications, Steam Generation, Mountings & accessories, Applications Babcock _ Wilcox & Lancashire Boiler. (8)

SECTION-B

UNIT- IV: Otto, Diesel Cycles : IC Engines , Classification - two stroke, four stroke petrol and diesel engines, Ignition system, cooling system, fuel injection system, Governing of IC Engines, calculation of Power developed and efficiency.

Air Compressors: Reciprocating and rotary compressors, working principles and applications, calculations of efficiency and work done for single stage reciprocatory compressors. (8)

UNIT- V : Carnot cycle, Rankine & Modified Rankine Cycle ,Steam Turbine , Flow of steam through nozzles, critical pressure ratio, maximum discharge, throat and exit areas; classification of steam turbines, velocity diagram, calculation of work done, power development, axial thrust & efficiency, Compounding and governing of steam turbines.

Gas Turbine: Introduction, Classification, such as open and close cycle turbines. Braylon Cycle, methods to improve efficiency.

(8)

UNIT-VI : Heat Transfer : Heat transmission by conduction, one dimensional heat conduction, convection heat transfer coefficient, resistance concept, electrical analogy, insulation, heat transfer convection, radioactive heat transfer , black and grey surface, dimensional analysis. (7)

TEXT BOOKS:

1. THERMAL ENGINEERING By: Mathur & Mehta, 03 (2010), M/s Jain Brothers, Karol Bagh, New Delhi - India, ISBN: 81-86321-86-1.
2. A TEXTBOOK OF ENGINEERING THERMODYNAMICS, , By: R. K. Rajput, 04 (2010), Laxmi Publications (P) Ltd.New Delhi, ISBN : 9788131800584
3. ENGINEERING THERMODYNAMICS: WORK AND HEAT TRANSFER, By: Gordon Rogers & Yon Mayhew , 4/e , Pearson Education, DELHI, INDIA, ISBN: 9788131702062.

REFERENCE BOOKS:

1. ENGINEERING THERMODYNAMICS, P. Chattopadhyay, 2010, Oxford University Press ,ISBN: 9780198060659.
2. HEAT AND THERMODYNAMICS (SIE), By: Mark Zemansky, Richard Dittman: 01 (2011), Tata McGraw-Hill Education, ISBN: 9780070700352.
3. BASIC & APPLIED THERMODYNAMICS, By: P. Nag (2009), Tata McGraw-Hill Education, New Delhi, ISBN: 9780070700352.
4. THERMODYNAMICS AND HEAT ENGINES (SI UNITS), By R.Yadav, Cental Publishing House, Allahabad. ISBN: 9788185444031.

3PE05 PRODUCTION TECHNOLOGY - I

Lecture: 04 Hrs/ w	Internal Assessments:	20
	University Exam:	80
	Credits:	04

Course Objective:

- To make the students understand the concepts & broad principles of contents of the course
- Sensitizes the students of the importance of course in real life environment
- To make the students understand the basic casting, foundry processes, recent trends and related operations used for manufacture of castings and technology with respect to manufacture, inspection and testing
- To familiarize with various welding processes and their applications

SECTION-A

UNIT- I : Introduction to pattern making: Pattern materials, pattern making, allowances, Types of patterns, General properties of molding sands, Mold hardness. Preparation of sand moulds of different types, Molding processes, core making.

Casting : Casting processes and their principle of operation and applications, Basic principle and Terminology of sand casting, Solidification of casting, Progressive and directional solidification gating system, types of gate , Risers design. (8)

UNIT- II: Melting & Pouring Of Metals: Melting furnaces pit, open hearth, gas fired cupola and electric hearth furnaces, cupola operation development in cupola melting

Electric Furnaces: Direct Arc, Indirect arc and electric induction furnace. Modernisation and Mechanisation of Foundries. (8)

UNIT- III: Special Casting Processes : Permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods.

Defects in castings: Origin and classification of defects, shaping faults, Inclusions and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors.

Inspection and Testing of Castings: Cleaning & finishing of castings, Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test. (9)

SECTION–B

UNIT- IV: Welding and Joining Processes: Requirements for welding, weldability. Classification of welding processes.

Arc Welding: Arc initiation, arc maintenance, and arc control, transfer of metal across the gap, Electrode efficiency, Types and purpose of Electrodes, I.S.F. for providing the shielding.

TIG & MIG Processes: TIG-Electrode polarity, loss and electrode contamination, shielding gases, MIG-Spray transfer and dip transfer processes

Gas Welding: Processes and equipment used, types of flame, gas welding technique adjustment of flame, oxy Acetylene welding, gas cutting - merits, limitations and applications. (9)

UNIT- V: Resistance Welding: Heat generation in resistance spot welding, operational characteristics of resistance welding processes such as projection welding, butt welding, percussion welding.

Friction Welding: Principle of operation of friction welding, forge welding, plasma arc, Thermit welding.

Brazing and Soldering: Braze welding and soldering processes types of flames, filler metals fluxes used merits, limitations and applications. Ultrasonic, Electroslag, Electron Beam, Laser welding. (9)

UNIT- VI: Welding Defects and Inspection: Welding defects, Testing and Inspection of welds.

Methods of Surface Improvements: Electroplating, electroforming, and iodising, metal spraying, Inhibitors, Cathodic and anodic protection, Coatings etc. Introduction to surface modification techniques such as Electro deposition, Diffusion coatings, Vapor deposition Thermal Spray Coatings, Ion implantation shot peening, polishing, mechanical cleaning. etc. (7)

TEXT BOOKS:

1. MANUFACTURING TECHNOLOGY : FOUNDRY, FORMING AND WELDING, By: P. N. Rao, 2008, Tata McGraw-Hill Education, ISBN: 9780070087989.
2. MANUFACTURING TECHNOLOGY, By: D. K. Singh , 2/e (2006) Pearson Education, DELHI, INDIA, ISBN: 9788131722275.
3. A TEXTBOOK OF MANUFACTURING TECHNOLOGY By: Dr. P C Sharma, 2 (2008), S.Chand & Company Limited, New Delhi, ISBN : 8121928214

REFERENCE BOOKS:

1. INTRODUCTION TO BASIC MANUFACTURING PROCESS & WORKSHOP TECHNOLOGY, By: Singh, Rajender, 2/e (2010), New Age International (P) Ltd., Publishers, DELHI, INDIA, ISBN: 9788122430707.
2. WORKSHOP TECHNOLOGY (MANUFACTURING PROCESS), By: S. K. Garg, 3/e (2009), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131806975 .
3. A TEXTBOOK OF MANUFACTURING TECHNOLOGY (MANUFACTURING PROCESSES), By: R. K. Rajput, 1/e (2007), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131802441 .

3PE06 / 3ME06 STRENGTH OF MATERIALS-LAB. / MECHANICS OF MATERIAL-LAB.

Practical:02 Hrs/ w — Practical Term Work: 25

Credit: 01

Practicals:

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.

5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3PE07 FLUID POWER SYSTEMS – Lab.

Practical: 02 Hrs/ w	Practical Term Work:	25
	Practical / Oral Exam:	25
	Credit:	01

TERM WORK:

At least ten experiments based on above syllabus as given below:

1. Pressure measurements by manometers.
2. Coefficients of discharge for Venturimeter.
3. Verification of Bernouli's equation.
4. Forces of impact of jet.
5. To find Reynolds number of a flow and its critical velocity.
6. To find Cc, Cv and D Cd for flow through orifice.
7. To find coefficient of discharge of a given notch.
8. Frictional losses through pipe and fittings.
9. Trial on reciprocating pump.
10. Trial on Centrifugal pump.
11. Trial /Study of Gear pump.
12. Study on Vane pump.
13. Study of piston pump.
14. Trial/Study of Hydraulic Ram.
15. Study of Valves.
16. Study of various Hydraulic Circuits.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

REFERENCE BOOKS:

1. FLUID MECHANICS WITH LABORATORY MANUAL, By: Majumdar, Bireswar, P., PHI Learning Private Limited, Delhi. ISBN: 9788120340343.
2. EXPERIMENTS IN FLUID MECHANICS, By: SINGH, SARBJIT, P., PHI Learning Private Limited, Delhi. ISBN: 9788120337626.

3. FLUID MECHANICS AND HYDRAULIC MACHINES A LAB MANUAL, By T. S. Desmukh, 2009, Laxmi Publications(P) Ltd.New Delhi, ISBN : 9789380386072.

3PE08 THERMAL POWER ENGINEERING – LAB.

Practical:02 Hrs/ w	Practical Term Work:	25
	Credit:	01

TERMWORK:

At least ten experiments based on above syllabus as given below:

1. Study of Water Tube Boiler.
2. Study of Fire tube boiler *(any two types).*
3. Study of steam turbine.
4. Study of two stroke and four stroke I.C. Engines.
5. Study of I.C. Engines Components.
6. Study and trial on a reciprocating air compressor.
7. Study of a rotary air compressor.
8. Determination of Dryness Fraction of steam.
9. Study of Thermodynamic cycles.
10. Study of Gas turbine.
11. Study of Heat conduction to composite wall.
12. Study of Stefan's Boltzmann Constant.
13. Study and Trial of a domestic refrigerator.
14. Study of Simple Steam power plant.
15. Study of parallel flow & counter flow heat convection.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3PE09 PRODUCTION TECHNOLOGY – I – LAB.

Practical:02 Hrs/ w	Practical Term Work:	25
	Practical / Oral Exam:	25
	Credits:	01

PRACTICE:-

1. **FOUNDARY :-** Sand preparation and practice in moulding of various types of patterns. Moulding 2 jobs, pattern making 2 jobs.
2. **JOINING PROCESSES:-** 2 composite jobs involving electric welding, gas welding and gas cutting.

   A journal should be prepared and submitted on above term work. The practical examination shall consist of a job preparation and college assessment should be based upon the jobs, termwork and viva examination.

REFERENCE BOOKS:

1. WORKSHOP PRACTICE, By: R. K. Rajput, 1/e (2011), Laxmi Publications(P) Ltd. New Delhi, ISBN: 9789380856650.
2. WORKSHOP PRACTICE, By H.S. Bawa, (2009), Tata McGraw-Hill Education, New Delhi, ISBN: 9780070671195.
3. Production Technology By: R.K.Jain.
4. Workshop Technology I & II By: Raghuwanshi.
5. Workshop Technology By: Hajra Chaudhary.

3PE10 PRODUCTION AND MACHINE DRAWING – LAB.

Theory: 01 Hrs/ w	Practical Term Work:	75
Practical: 02 Hrs/ w	Practical / Oral Exam:	25
	Credits:	03

Course Objective:

- Understanding, preparation and reading of 2D drawings of various machine parts and
- Assemblies used in industry and basics of computer aided drafting practices.
- Basics of computer aided drafting.

UNIT I: **Sectional Views:** Conversion of pictorial view into sectional orthographic projections, sectional views with different types of sections, missing views.

UNIT II: **Development of Surfaces:** Development of surface of Cubes, Prisms, Cylinders, Pyramids and Cones.

UNIT III: **Intersection of Surfaces:** Interpenetration of solids, prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism.

UNIT IV: **Preparation of Sketches:**

1. Latest ISI conventions covering the standard practice in Machine Drawing.
2. Conventions for various components like bearing, gears, springs, key and key ways, threads, tap holes and materials.
3. Symbolic representations for working drawing for welded joints.
4. Use of specifications for limits, fits and tolerances.

5. Conventions used for surface roughness i.e. machining symbols, M/c allowance symbols etc.
6. Rivets & Riveted joints.
7. Keys, Cotters and cotter joints, knuckle joints and couplings.
8. Bearing and bearing mountings.
9. Engine & machine tool components.

UNIT V : **Detail And Assembly Drawing :** Preparation of detail and assembly drawing of simple machine assemblies, like pedastal bearing, plummer block, simple eccentric, stuffing box, cross head, connecting rod, tail stock, tool post, C-clamp, screw jack, crane hook, etc.

UNIT VI: **Basics of Computer Aided Drafting :** Basics of computer aided drafting commands such as line, circle, rectangle, ellipse, arc, spline ,hatching ,etc. Editing commands, Basic Dimensioning, Creating 2-D simple machine parts and assembly.

TERM WORK:-

A. Drawing Sheets:
   1. Sectional views of some objects.
   2. Missing views.
   3. Development of surfaces
   4. Intersection of solids.
   5. Preparation of production Drawings of assembly of different machine elements from details.
   6. Preparation of production Drawings of details of different machine elements from assembly.

B. **Sketch Book:** Preparation of sketches mentioned in UNIT IV

C. **Computer Print:** At least four computer outputs using graphic packages for the engineering applications such as -
   1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) –
   2. Creation of simple figures like polygon and general multi-line figures.
   3. Drawing of a Title Block with necessary text and projection symbol.
   4. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
   5. 2D Profile of standard machine parts such as Keys, Cotters and cotter joints, knuckle joints and couplings, etc.
   6. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc,

7. Drawing front view, top view and side view of objects from the given pictorial views
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc, and dimensioning.
9. 2D - Isometric drawing of simple m/c components.

PRACTICAL EXAMINATION:-

External viva voce will be conducted based on term work and above syllabus.

TEXT BOOK:-

1. **Production Drawing,** Narayana K. L., Kannaiah P., Venkatata Readdy K., , 2nd Edition, New age international Publishers, Delhi, 2008, ISBN 978-81-224-2288-7.
2. **Machine Drawing,** Ajeet Singh, DEC-07, TMH, NEW DELHI, ISBN: 9780070659926
3. **Machine Drawing,** Bhat N. D., Panchal , , Charotar Pub. House, ANAND
4. **Engineering Drawing,** Bhat N. D., Panchal , Charotar Pub. House, ANAND

REFERENCE BOOKS:

1. TEXT BOOK OF MACHINE DRAWING (With Computer Graphics) (First Angle Projection) Lakshminarayanan & Mathur 13th Ed., Rep. 2010 , M/s Jain Brothers, New Delhi, ISBN: 81-86321-33-0
2. ENGINEERING GRAPHICS (Including AutoCAD)(First Angle Projection) Lakshminarayanan & Vaishwanar 16th Ed., 2009, M/s Jain Brothers, New Delhi, ISBN: 81-86321-69-1
3. A Text book of Machine Drawing, Gill P. S. Revised Edition K. Kataria and Sons,New Delhi, 2008, ISBN 81-85749-79-5.
4. Machine Drawing by N. Sidheswar, Shastri, Kanaiah, TMH
5. Machine Drawing by R.K.Dhavan, G.R. Nagpal, S. Chand & Co.
6. Graphic Science & Design by French, Vierck & Foster McGraw Hill

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SEMESTER : FOURTH

4PE01/4ME01 BASIC ELECTRICAL DRIVES & CONTROL

Lecture: 03 Hrs/ w		Internal Assessments:	20
Tutorial: 01 Hr/w		University Exam:	80
		Credits:	04

Section-A

Unit I : Concept of general electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Introduction to mechatronics, Theory and principle of Power Transistor, SCR

Unit II : Basic characteristics of D.C. motor, Torque equation, Modified speed – Torque characteristics. Starting and braking of Electrical D.C. motors, comparison of mechanical and electrical braking methods. Introduction, Principle, construction and working of Servo motors, stepper motors, Brushless D.C. motors.

Unit III : Classification of A.C. motors, construction, types, principle of working and characteristics of 3 phase Induction motors, applications. Starting and braking of 3 phase induction motors. Classification of single phase induction motors. construction, principle and working and applications. Principle and working of universal motor.

Section-B

Unit IV : Conventional methods of speed control of A.C. and D.C. motors. Thyristorized stator voltage control of 3 phase induction motor, (v/f) control method, slip-power recovery scheme. Thyristorized armature voltage control of D.C. motors using phase control & Thyristorized chopper.

Unit V : Basic principle, construction & applications of sensors and transducers, contact - non- contact type, optical proximity sensors. Switches, contact type, magnet type, electromagnetic type, sound, light, pressure, vibration transducers, Hall effect-sensors A.C./D.C. Tachogenerators.

Unit VI: Industrial applications - classes of duty selection of an electric drive for particular applications such as steel mill, paper mill, cement mill, textile mill, sugar mill, electric traction, coal mining, etc. Induction heating, surface hardening & Dielectric heating.

Books Recommended

Text Books:-

1. A First Course on Electrical Drives - S.K. Pillai.
2. Basic Electrical Technology (Vol. 11) - B.L. Theraja

Reference Books :

1. Drives and Control - N. Dutta
2. Mechatronics - W.Bolton, Addison Wesley, Longman Ltd., 1997.
3. A Course in Electrical, Electronics Measurement and Instrumentation, By A.K.Sawhney, Dhanpat Rai & Sons, 2006

4PE02 MATERIAL TECHNOLOGY

Lecture:03 Hrs/ w

Internal Assessments: 20
University Exam: 80
Credits: 03

Course Objectives:

To make the students understand the concepts & broad principles of contents of the course

Aim is to provide insight of the subject , sensitizes the students of the importance of course in real life environment

SECTION - A

UNIT - I : **Introduction to metallurgy:** Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy. Classification of materials & their application Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation lever rule for phase mixtures.

Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification Introduction to processes for chemical analysis of metals: spectrometry, gravitometry. (07)

UNIT - II : Study of binary equilibrium diagram and invariant reactions Construction and study of Iron-carbon Equilibrium Diagram Critical temperatures Microstructure of slowly cooled steel Estimation of carbon from microstructure, structure property relation. Introduction to composite materials, advantage and applications. (07)

UNIT- III : **Alloy Steels**: Classification and application of plain carbon steel Effect of grain size and impurities on properties of plain carbon steel Purpose of alloying, classification of alloying elements and their effect on steels, effect on transformation in

steel, Low alloy engineering steels and High speed steels, their heat treatments and applications. Ferritic, Austenitic and Martenstic stainless steels, their properties and applications, weld decay in stainless steel. (08)

SECTION-B

UNIT- IV : **Cast irons :** Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.

Non Ferrous Metals and Alloys : Types, Properties and usesof Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (07)

UNIT- V : **Principles of Heat Treatment**: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on ‘s’ Curve. Characteristics of pearlite, bainite and martenstics transformation during continuous cooling. Quenching media, severity of quench, Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability, Methods of surface hardening: Carborizing, Nitriding, Cyaniding, Flame and Induction Hardening. (08)

UNIT- VI : **Mechanical working of Metals**: - Hot and cold working, Relative advantages and dis-advantages, study of stressstrain curve, luders bands Work hardening, strain Ageing; Recovery, Recrystallisation and grain growth. Metallurgical factors affecting various working processes, preferred orientation, Deformation mechanisms-Slip, twining, critical resolved shear stress.

Powder Metallurgy: Manufacture of metal powders, Atomization, Milling, Reduction, Electrolysis, carbonyl. Process; Single die and double die compaction, sintering, stages of sintering. Manufacture of porous bearings a n d cemented carbide tip tools by P.M.techniques. Advantages, limitations and applications of powder metallurgy. (08)

TEXT BOOKS:

1. V.D. Kodgire: Material Science and Metallurgy for Engineers. Everest Publishing House, Pune.
2. Smith W.F.: Principles of Material Science and Engineering: McGraw Hill Book Co.

REFERENCE BOOKS:

1. Davis H. E., Troxell G.E. and Wiskocil C. T.: Testing of Engineering Materials. Mc Graw Hill Book Co.
2. Van Vlack L.H.: Elements of Material Science. Addison- Wesley Publishing Co.
3. Baldev Raj, T. Jayakumar and M. Thavsimuthu: Practical Non-Destructive Testing. Narosa Pub. House. Delhi.
4. Hull and T. W. Clyne: An introduction to Composite Materials: 2/e, Cambridge Solid State Science Series.
5. Structure and properties of materials II, Willey Eastern (P) Ltd.
6. Structure and properties engineering materials, by Murthy -Tata McGraw Hill 2003.
7. Donald R. Askland, P.P. Phule-Science and engineering of materials, Thomson Learning (2003)

4PE03 THEORY OF MACHINES

Lecture:04 Hrs/ w	Internal Assessments:	20
Tutorial:01 Hrs/ w	University Exam:	80
	Credits:	05

Course Objectives:

- To develop the ability to understand the concepts of mechanisms and the kinematic analysis of mechanisms.
- To make the students conversant with basic concepts and theory regarding friction, lubrication, belt, rope, chain
- drives, Gears and Gear Trains and vibrations.

SECTION-A

UNIT- I : **Mechanisms :** Introduction to study of mechanism & machines, Basic definitions, Kinematic pair and chains; Inversions of Four bar, slider crank and double slider mechanism. Common Mechanism : Straight line mechanism; Quick return Toggle mechanism; Steering mechanisms. Binary joints in chain, Kutzbatch's criterion, Grubler's criterion. (8)

UNIT- II : **Velocity and Acceleration Analysis:** Relative velocity and acceleration method; Instantaneous centre method; Analytical method for determination of velocity and acceperation in slider crank mechanism. Klein's costruction.

Cams: Types of Cams and followers ; Field of applilcation; Graphical layout of radial cams. (8)

UNIT- III : **Gears and Gear Trains :** Terminology for all types of gears; law of involute gearing; Interference and methods to reduce it, Gear trains, Velocity ratio.

Friction and Lubrication : Friction in pivot and collars Types of friction, laws of friction, limiting angle of friction, inclined plane theory, efficiency of inclined plane. (9)

SECTION-B

UNIT- IV : **Belt Drives:** Types of Belts, angular velocity ratio, effect of belt thickness, effect of slip, length of belt, angle of contact, angle of lap, law of belting, crowning of pulley, limiting tension ratio, power transmission, centrifugal tension in the belt and its effect on power transmission, initial tension and its effect on power transmission. Creep of belt (Numerical treatment expected)

Brakes: Types of brakes, Force analysis of brakes, external and internal expanding shoe brakes block brakes, band brakes, block and band brakes, Breaking torque. (Numerical treatment expected)

Dynamometer: Different types of Absorption and transmission dynamometers. (9)

UNIT- V : **Dynamic Force Analysis** :- Inertia forces; D'Alemberts principle; Dynamic force analysis of slider crank mechanism; Shaking forces, TQ diagram; Flywheel reqirement.

Governors: Types of governors, centrifugal, watt, porter, Proell, Hartnell governors, sensitivity of governor, effort of a governor, controlling force.

Flywheel: turning moment of flywheel, coefficient of fluctuation of energy , energy stored in flywheel, flywheel in punching press. (9)

UNIT- VI : **Vibration Analysis:** Introduction to longitudinal, Transverse and torsional vibrations; free and forced vibrations with and without damping; critical speed.

Balancing: Static and dynamic unbalance; Balancing of several rotating masses in single and multi transverse planes. (7)

TEXT BOOKS:

1. A TEXTBOOK OF THEORY OF MACHINES (IN S.I. UNITS), By: Dr. J. S. Brar ,Dr. R. K. Bansal, 5/e (2011), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131808054
2. THEORY OF MACHINES AND MECHANISMS, By: John J. Uicker, Gordon R. Pennock, The late Joseph E. Shigley ,3/e (2009), Oxford University Press, DELHI, INDIA, ISBN: 9780198062325.
3. THEORY OF MACHINES, By: S Rattan, Edition: (2009), Tata McGraw-Hill Education, ISBN: 9780070144774.

REFERENCE BOOKS:

1. THEORY OF MECHANISMS AND MACHINES, By: Purohit, Kamlesh, Sharma, C. S., PHI Learning Private Limited, Delhi. 9788120329010.
2 A Textbook of Theory of Machine, By R.S.Khurmi, 14/e, S.Chand & Company Limited, New Delhi, ISBN: 812192524X.
3 KINEMATICS & DYNAMICS OF MACHINERY, By: Robert Norton, Edition: (2009), Tata McGraw-Hill Education, ISBN: 9780070144804.

4PE04 PRODUCTION TECHNOLOGY - II

Lecture: 04 Hrs/ w	Internal Assessments:	20
	University Exam:	80
	Credits:	04

Course Objectives:

- To study the various conventional and basic Machine Tools and manufacturing processes carried out on these machines for different applications.
- To study the various advanced Machine Tools, as well as Non-Conventional Machine Tools and manufacturing processes carried out on these machines for different applications.

SECTION-A

UNIT- I : Introduction to theory of Metal cutting, Tool material, Tool Geometry, Machinability, Cutting fluid, Machine Tool classification.

Construction, Operations and accessories of centre lathe, introduction of capstan & turret lathe, indexing mechanisum, bar feeding mechanism, introduction to Automatic screw machines & Single spindle and multi-spindle automat. (8)

UNIT- II : Drilling Machine: general purpose, Mass production and special purpose drilling M/cs.

Boring Machine: Horizontal, Vertical and jig Boring M/c.

Grinding Machines: Bench grinders, surface grinders, centreles grinders, types of bonds & Abrasive modification of grinding wheels.

Processing of plastics by compression, Transfer, Injection, Extrusion. Blow-moulding, Rotational moulding and calendering. (9)

UNIT- III : Milling Machines: Types, Types of Milling Cutters, Dividing head, Compound and differential indexing.

Gear producing Machines.

Study of various part & Operation of Shaper, Planer, slitter and power hack saw. (8)

SECTION-B

UNIT- IV : Unconventional Machining Processes:-

Mechanical Processes:- Ultrasonic Machining - principle and applications. process parameters ; Abrasive and water abrasive jet machining :- Mechanism of metal removal parameters involved.

Thermal processes:- Election Beam Machining – Generation of beam, principle and applications : Laser Beam machining applications : Plasma-arc machining- Concept and generation of plasma, principle of PAM, applications.

Electro Chemical Machining- Classification, fundamentals: Electro mechanical milling.

Electric discharge Machining - Types dis-sie-onking, wire EDM, Mechanism of material removal, process parameters, advantages and applications. (9)

UNIT- V : Surface finishing processes and coating: Super finishing processes, honing, lapping, buffing, polishing, tumbling, electroplating, galvanizing, metal spraying, and burnishing. Hot dipping, Study of process parameters of above processes.

Automats: Major classification, horizontal and vertical, single spindle and multi-spindle, bar type and chuck type, screw type and Swiss type, tool and tool holders, typical tooling set-up for simple work pieces, special attachments, threading attachments, high speed drilling attachments, chutes, magazines, and hoppers for feeding (9)

UNIT- VI : Micromachining: Fundamentals of micro fabrication. Tool material interaction during micromachining Mechanical Micromachining; Micro-drilling, micro-milling, micro-turning processes. Thermal Micromachining processes; micro-EDM, micro wire EDM, micro-ECM, LASER based micromachining, LIGA. Micro-electro-mechanical Systems (MEMS). Measurement techniques in micro engineering. (7)

TEXT BOOKS:

1. MANUFACTURING TECHNOLOGY : METAL CUTTING & MACHINE TOOLS By: P N Rao, (2008), Tata McGraw-Hill Education, ISBN: 9780070087699.
2. A TEXTBOOK OF MANUFACTURING TECHNOLOGY (MANUFACTURING PROCESSES) , R. K. Rajput , 1/e (2007), Laxmi Publications(P) Ltd.New Delhi, ISBN : 9788131802441.
3. A TEXTBOOK OF MANUFACTURING TECHNOLOGY By: Dr. P C Sharma, 2 (2008), S.Chand & Company Limited, New Delhi, ISBN : 8121928214

REFERENCE BOOKS:

1. MANUFACTURING ENGINEERING HANDBOOK, By: Hwaiyu Geng, Edition: (2004), Tata McGraw-Hill Education, ISBN: 9780071398251.
2. MICROMANUFACTURING AND NANOTECHNOLOGY, By: Mahalik, N.P. , 1/e, (2007), New Age International (P) Ltd., Publishers, DELHI, INDIA, ISBN: 9788181285058
3. PRODUCTION TECHNOLOGY, By :Hindustan Machine Tools, (2004), Tata McGraw-Hill Education, ISBN: 9780070964433.
4. MODERN MACHINING PROCESSES, By : P Pandey, H Shan, (1980), Tata McGraw-Hill Education, ISBN: 9780070965539.
5. Fundamentals of Metal Cutting and Machine Tools, By: Juneja, B.L. , 2/e, (2010), New Age International (P) Ltd., Publishers, DELHI, INDIA, ISBN: 9788122414677

4PE05 MEASUREMENT SYSTEMS

Lecture: 04 Hrs/ w	Internal Assessments:	20
	University Exam:	80
	Credits:	04

Course Objectives:

- Know fundamentals of mechanical measurement systems, Applications of measurement systems as per Industrial requirements.
- Suggest suitable sensor for given applications, Procure and install the sensor

SECTION - A

UNIT- I : **Generalised measurement system:** significance of measurement, generalised systems, application of measuring instruments, types of measuring instruments.

General configuration and functional elements of measuring instruments, types of inputs, various methods of correction for interfering and modifying inputs. (7)

UNIT- II : **General performance characteristics:** Static characteristics, different types of errors, combination of component errors in overall systems.

Dynamic characteristics: general mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency. (9)

UNIT- III : **Strain measurement:-** types of strain gauges, strain gauge circuits, calibration, temperature compensation, use of strain gauges on rotating shafts, selection and installaiton of strain gauges.

Pressure measurements:- basic methods of pressure measurement, manometers, transducers-elastic, gravitational, elastic : draph, strain gauge pressure cell, high pressure measurement Bridgeman type, low pressure measurement - Mcleod, Krudsen, ionisation, thermal conductivity gauges. (9)

SECTION - B

UNIT- IV : **Force measurement:** various mechanical, hydraulic, pneumatic and electrical methods.

Torque and power measurements: various mechanical, hydraulic & electric methods.

Flow measurements: construction- Venturi, Orifice, Dall tube, rotameter, pressure probes- Pitot static tube, yaw tube anemometer, positive displacement flow meters, turbine meter, electro-magnetic flow meter. (9)

UNIT- V: **Temperature measurements:-** standards, various temperature measuring devices, bimetallic strip, liquid in glass thermometer, pressure thermometers, thermo couples, electrical resistance thermometers, thermistors, radiation thermometors.

Liquid level measurements: various methods such assingle flot, displacement or force transducers, pressure sensitivity, bubbler or page system, capacitance variation type (for both conducting and non conducting type liquids) resistance variation type, radioisotope. (8)

UNIT- VI: **Speed measurements:** various mechanical type techometers, electrical types tachometers, stroboscope etc.

Vibration measurements: seismic, strain gauge and peizoelectic accelerometers.

Displacement measurements: linear and angular displacement measurements, LVDT, LDR, capacitive & inductive pick ups.(8)

Text Books :

1. Rangan , Sharma,'Instrumentation Devices and Systems', Mani-Tata McGrawhill- Second Edition.
2. Nakra,Chaudhary,' Instrumentation Measurement and Analysis', Tata McGrawhill-21st Reprint.
3. Principles of Industrial Instrumentation- D. Patranabis-Tata McGrawhill-7th Reprint,1986
4. Electrical and Electronic Measurements and Instrumentation- A. K. Sawhney- Dhanpat Rai and Sons , Delhi-2002print
5. Mechanical and Industrial Measurement- R.K.Jain- Khanna Publications-9th print

Reference Books :

1. Andrew, Williams,'Applied Instrumentation in Process Industries (Vol. I)'-Gulf Publications Company- Second Edition
2. B. G. Liptak- Butterworth Heinemann, 'Process Measurement and Analysis' Third Edition
3. Jone's Instrument Technology (Vol. 1 and Vol. 2)- B. E. Noltingk EL / BS- Fourth Edition
4. E. O. Doebelin, 'Measurement System Application and Design- McGrawhill International- Fourth Edition.

4PE06 / 4ME06 BASIC ELECTRICAL DRIVES & CONTROL-LAB.

Practical:02 Hrs/ w — Practical Term Work: 25; Credit: 01

List of Experiments

Any eight practicals from the following list:

1. To study the Specification of Various Electrical Machines. 2. To study the D.C. Motor Starters.
3. To study the Running and Reversing of D.C. Motor.
4. Speed Measurements using Magnetic Pick-up.
5. To study the Speed reversal of counter Current Breaking of 3-phase Induction Motor.
6. To control the speed of D.C. Motor by a) Armature Control b) Field Control.
7. To perform Load Test on Induction Motor.
8. To study Dynamic/Rheostatic Breaking of D.C. Motor.
9. To study Characteristics of Thyristor.
10. To study the speed -Torque Characteristic of Servo Motor.

4PE07 MATERIAL TECHNOLOGY – LAB.

Practical:02 Hrs/ w — Practical Term Work: 25; Credit: 01

Course Objectives:

- To develop skills in the subject and Verify the principles of the course
- Application of the theory and Understanding of fundamentals of the subject

TERMWORK:

Practical Minimum 10 out of following:

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalised plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of Brasses.
8. Study of micro structures of Bronzes.
9. Study of micro structures of White metal bearing alloys and alloys.

10. Study of micro structures of hardened and tempered steels.
11. To study F.e.(Equilibrium diagram & Allotropie forms of fe)
12. To study different Heat Treatment Process for steel.
13. To study different surface Haldening processes for steels.
14. To study effect of alloying elements on the properties of steels.
15. To measure variation in hardness by hardness tester (Jominy end quench test apparatus)
16. Study of hardness tester and conversion of Hardness number
17. Industrial visit to study heat treatment plant.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

Text Books:

1. Electrical machinery and transformer by Irvin Kosow, Prentice Hall
2. Thomas L Floyd Electronics Devices, 5th Edition Pearson, India, 1999.

Reference Books:

1. Electronic Devices & Circuit Theory : Boylestad & Nashelsky,PHI Publishing
2. Electric Machines and Transformers :Anderson Leonard D. &Jack McNeil
3. OP- Amplifier : Gayakwad,Pearson Publications Edition,2009
4. Microprocessor :Gaonkar,Fifth Edition,Penram International Publishing
5. Digital Principle and Applications: Malvino & Leach,Fifth Edition,Medium Publishing
6. Computer Based Industrial Control By Krishna Kant PHI-Mechatronics – by Bolten.
7. Allen Mottershed, Electronics Devices and circuits, Twentieth Indian edition, New Delhi ,1998.
8. Digital Principles and Application By Albert Paul Malvino, Donald P Leach
9. Electrical machinery S.K. Bhattacharya, T.T.T.I. Chandigarh
10. Electrical machines & Power system vol 1. Syed A. Asar , McGraw hill
11. Fractional and sub fractional horse power electrical motors. C.E. Veinou and J.E. Martits , McGraw hill
12. Electrical engineering handbook Siemens, Wiley eastern
13. Process Instrumentation Hand Book. By Cinsidine MGH

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course

4PE08 THEORY OF MACHINES – Lab.

Practical: 02 Hrs/ w

Practical Term Work: 25
Practical / Oral Exam: 25
Credit: 01

Objectives:

- To make the students understand the concepts & broad principles of contents of the course
- Develop conceptual framework of the course.

TERMWORK:

Practical Minimum 10 out of following:

1. Study of inversions of four bar mechanism.
2. Study of inversions of slider crank mechanism.
3. Study of inversions of double slider mechanism.
4. Velocity analysis of mechanisms.
5. Graphical layout of radial cam.
6. Acceleration analysis of mechanisms.
7. Determination of velocity ratio in gear trains.
8. Graphical layout of involutes Gear profile.
9. Study of various brakes..
10. Study of various clutches.
11. Static and dynamic balancing of rotating masses.
12. Determination of inertia force of connecting rod by graphical method.
13. Study of different types of gearboxes.
14. An experiment for finding radius of gyration of a flywheel by triflers' suspension method.
15. An experiment for finding radius of gyration of a flat bar using theory of compound pendulum.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

4PE09 PRODUCTION TECHNOLOGY - II – Lab.

Practical:02 Hrs/ w

Practical Term Work: 25
Practical / Oral Exam: 25
Credit: 01

Objectives:

- To give students 'hands on experience' of craftsmanship ,machining, maintenance and assembly.

- To make students familiar with different Work Trades.
- To develop quality & safety consciousness amongst the students.
- To develop respect towards labour work amongst the student.

Comments : Students should wear safety apron and safety shoes during the practical.

PRACTICALS:-

Introduction of machining operations related to Lathe, Shaper, Slotter, Drilling & Grinding Machine.

Machine shop practice:

1. One job on lathe covering taper turning and threading.
2. One job on shaping covering plane and inclined surfaces.
3. One job on milling machine.

   The above jobs should include drilling, grinding, tapping etc.

Demonstrations:

1. Demonstration of plastic moulding machine.
2. Machine part assembly: Demonstration and exercise on assembly of machine parts in a group of students.
3. Machine maintenance: Introduction of Preventive and breakdown maintenance, demonstration and exercise on inspection of a machine, minor repairs and lubrication.

Term work should be submitted in the form of journal including

1. Study of single point tool geometry
2. Study of important accessories of machine tools.
3. Study of cutting fluids

N.B. :- The practical examination shall consists of preparation of practical jobs and assessment by external and internal examiner.

4PE10 MEASUREMENT SYSTEMS – Lab.

Practical: 02 Hrs/ w	Practical Term Work:	25
	Practical / Oral Exam:	25
	Credit:	01

TERMWORK:

Practical Minimum 08 out of following:

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-up transducers.
4. Performance of capacitance transducer as a angular displacement measuring device.

5. Performance of inductive transducers.
6. Flow measurement.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or photo electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement.
11. Liquid level measurement.
12. Temperature measurement.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS
PRESCRIBED FOR
FIVE YEAR DEGREE COURSE IN
BACHELOR OF ARCHITECTURE
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER: THIRD

03AR01 APPLIED MATERIALS

Objective : To expose the students to the various types of building finishing materials.

Unit I : Different types of furnishing and finishing materials for Interior and Exterior surfaces. Special finishes like aluminum based materials , anti-corrosive and water bound paints .

Unit II: Paving and Cladding materials-natural and artificial , its types.

Unit III: Polymers and polymer based materials for walls , pipes, sanitary ware, glues and mastic. Polycarbonate and acrylic materials , its properties.

Unit IV: Manufactured timber based materials for interior such as plywood's, veneers , mica, laminates,etc. Types of materials useful for false ceiling , its properties.

Unit V: Material useful for different types of partitions. Alluminium, plastic, glass and different alloy and its application in the building industry.

Unit VI : Acoustical materials , metals used for steel cables, structural glazing and curtain walling. Sessional work: Test, assignment and Material survey report.

References :

1. S.C. Rangwala, Engineering Materials, Charotar publishing House, Anand, 1997.
2. R.K.Rajput , Engineering Materials.
3. Don. A. Watson, Construction Materials and processes, Mc Graw Hill Co. 1972.

03AR02 BUILDING MATERIALS & CONSTRUCTION- III

Objective : The course will enable the learning in progression , starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization .

Unit I : An introduction to timber floors and its specific application to various activities. Detail study of single joist, double joist and triple joist timber floors.

Unit II : Application of false ceiling materials such as asbestos sheets, soft boards, acoustic boards, plaster of paris etc; on timber, steel or aluminium framework.

Unit III : Cement and its varieties, composition, properties and uses; brief study on manufacture of Portland cement; test for cement; mortars for various work.

Unit IV : Concrete, its ingredients, manufacture & properties, ingredients suitability requirements for aggregates, grading of aggregates, role of water, reinforcement, admixtures in concrete, properties of concrete. Manufacturing of concrete and concreting , grades of concrete, mixing of proportions, placing, compactions, transporting, curing, testing of concrete, joints in concrete and concrete finishes.

Unit V : Introduction and purpose of foundation. Brief introduction to types of shallow and deep foundation. Detail study of masonary foundation & R.C.C. footing foundations and its types.

Unit VI : Formwork and its importance to R.C.C. building elements such as column footing, columns, beams, arches, slabs. Comparative analysis of timber & steel formwork.

Sessional work: Assignments, test,site visit and drawing on the above topics.

References:

1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand,1997
2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. Mckay Building Constrution, vol. 1,2,3, Longmans, U.K.1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

03AR03 HISTORY OF ARCHITECTURE – II

Objective : History of Architecture exposes the student to evolution of different architectural solutions through historical periods to understand the building materials, construction techniques, planning and designing features.

Unit I : Egyptian and Mesopotamian Architecture and its impact on social, economical and geographical conditions.

Unit II : Introduction to the western civilization and study of Greek civilization and its impact on Architectural development.

Unit III : Introduction to the Roman Architectural development and study of public buildings and spaces.

Unit VI : Brief study of Romansque, Gothic, Byzantine and renaissance architecture.

Unit V : Introduction to Islamic architecture. Evolution of building types in terms of forms and functions.

Unit VI : The architectural development of the mosque, the tomb, minaret, the madarasa etc; method of construction and building elements.

Sessional work; Assignments and drawing on the above topics.

References:

1. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone press, 1986.
2. Percy Brown, Indian Architecture (Islamic period), Taraporevala and Sons, Bombay, 1983
3. Satish Grover, The Architecture of India (Buddhist and Hindu Period), Vikas Publishing Housing Pvt. Ltd., New Delhi, 1981
4. Christopher Tadgelli, The History of Architecture in India from the Dawn of Civilization to the end of Raj, Longman group, U.K.Ltd., London, 1990

03AR04 APPLIED CLIMATOLOGY- I

Objective: The prime objective of this course is to understand global environmental factors and climatic zones to be utilized for designing the spaces.

Unit I: Introduction to solar system and Earth – Sun relationship and its impact on earth surfaces.

Unit II: Thermal balance of Earth, global trade wind pattern, coriolisis effect and tropical zones on earth surfaces.

Unit III: Human comfort through body metabolism, heat gain and heat loss, thermal balance of body, clothing pattern its effect on body.

Unit IV: Climatic factors that influence climatic elements; study of climatic factors such as Altitude, longitude, latitude, seasons,

water bodies, vegetation, rainfall, topography, urbanscape, sky conditions, global trade wind pattern, soil conditions etc; its impact on basic climatic elements.

Unit V: Climatic elements and data collection equipments. Air temperature, inversion of temperature, thermal diffusivity, thermal conductivity, effective temperature. humidity its types, solar radiation and its effects on building surfaces, wind – study of diurnal and seasonal variations, wind eddies, stack effect, Precipitation- rain, water vapour, fog and snow. Measurement and graphical presentation of climatic data. Use of bioclimatic and psychometrics chart.

Unit VI: Tropical climates and its types with characteristics.

Sessional work; Assignments and test on the above topics.

References:

1. O.H.keonigsberger; T.G. Ingersoll and others; Manual of tropical housing and building- Part-I; Longmans,London-1980
2. M. Evans; Housing, climate and comfort; Architectural press London-1980
3. B.G.Givoni; Man,climate,and architecture; Applied science, banking, Essex, 1982
4. N.K Bansal and others; Passive building design; Elsevier science-1994.
5. S.Drake; The third skin architecture,technology and environment; UNSW –press-2007.

03AR05 ARCHITECTURAL STRUCTURE-II

Objective: To understand loading, structural elements and to analyse them.

Unit I: Strain energy in tension, compression and shear; tention member under impact load.

Unit II: Theory of simple bending in beams. Distribution of shearing and bending stress on horizontal section.

Unit III: Column and struts, Euler’s theory of long column, Rankin theory.

Unit IV: Foundation design soil aspects.

a) Importance of the subject. b) Types of soil and their properties. c) Method of compaction and consolidation. d) Void ratio porosity, bulk density, moisture content, degree of saturation, liquid limit, plastic limit. e)Test for assessing load bearing capacity of soil. f) soil properties and characteristics relevant to the design of foundation. g) criteria for selection of foundation type for different soil condition. e) effect of water level, settlement of soil.

Unit V: Direct and bending stresses, eccentric loading on short column, middle third rule, chimneys.

Sessional work; Assignments and tutorials on the above topics.

References :

1. P.C.Punmia, Strength of Materials and Theory of Structures; vol I, Laxmi Publications, Delhi 1994.
2. S.Ramanmurtham, Strength of Materials – Dhanpatrai & Sons, Delhi 1990
3. W.A.Nash, Strength of Materials – Schaums Series – McGraw Hill Book Company, 1989
4. R.K.Bansal – engineering Mechanics and Strength of Materials – Lakshmi Publications, Delhi, 1990

03AR06 ARCHITECTURAL DESIGN STUDIO – III

Objective: The prime objective of this course is to introduce architectural design as a process and as a final product; to understand fundamentals of space, form and order through basic perception of architectural skills.

Basic contents:

1) Introduction to the design assignment, their aims and objectives, scope, special emphasis and limitation. Application of planning and design standards for the proposed design project.
2) Planning and design data collection, area analysis, study and evolution of plan forms for each activity, grouping of activities, case study analysis and its presentations.
3) Major design project shall include house design, clinic, elementary school, restaurant with respect to planning & design aspect.

Sessional work: One major design project and one time project with other task and assignments.

Suggested text books:

1. Ching, F.D.R. : Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals

Edward d Mills- Planning the Architects Hand Book – Bitterworth, London, 1985.

4. Watson,D (editor) Time –saver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.
5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G., “Form defining strategis: experimental architectural design”. Wasmuth, 2007.

03AR07 BUILDING MATERIALS & CONSTRUCTION STUDIO - III

Sessional work :

Assignments and drawing on the above topics given in the subject 03AR02 Building Materials & construction – III. Viva Voce by external examiner at the end of Semester.

03AR08 COMPUTER GRAPHICS STUDIO- I

Sessional work :

Assignments and 2D projects on the above topics given in the subject 01AR04 computer graphics- I in the soft and hard copies. Viva Voce by external examiner at the end of Semester.

03AR09 SURVEYING AND LEVELLING-LAB

Objective: To impart knowledge about the basic principles of geomatics engineering for mapping and other applications.

Unit I: Importance of geomatics engineering techniques to architecture, field surveying, photogrammetry, remote sensing, geographic information system and global positioning system.

Unit II: Types of maps, scales and uses, map sheet numbering, map projection, definition of surveying, principles, importance, classification, surveying equipment namely levels, compass, theodolites, tachometer, EDM, total stations and other instruments.

Unit III: Measurement of distance, angles, and directions; determination of elevation through spirit leveling, trigonometrically leveling, tachometric surveying and contouring.

Unit IV: Method of control establishment namely traversing, triangulation, plane table surveying and mapping. Introduction to GPS survey.

Sessional work :

Assignments, test and tutorials on the above topics.

Practicals:

a) Chain and compass surveying. b) Levelling c) Plain table surveying and preparation of map. d) Determination of height of a building.

Suggested books:

1) Schofield W., Engineering surveying., Butterworth-Heinemam.,2007.
2) Chandra. A.M., Surveying., New Age publisher-2000.

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SEMESTER: FOURTH

04AR01 ARCHITECTURAL DESIGN – IV

Objective: To expose the students to the designing of multifunctional community buildings with emphasis on building bye laws, impact of culture, traditions, material and techniques.

Basic contents:

1) Introduction to the designing of multifunctional community buildings on an intermediate scale.
2) Importance of case studies, data collection, area analysis, evolution of plan forms, climatic oriented planning and design features, space utilization, building & site services, site analysis and site planning ,etc; in the Architectural design process.
3) Importance of culture, tradition, topography, climate and building bye laws in generating built form.
4) Major design project may include design of library, club, gymnasium, low rise apartment, low cost housing element, office cum shop, etc.

Sessional work:

One major design project and one time project with other task and assignments.

Suggested text books:

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals
   Edward d Mills- Planning the Architects Hand Book – Bitterworth, London, 1985.
4. Watson,D (editor) Time –saver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.

5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G., “Form defining strategis: experimental architectural design”. Wasmuth, 2007.

04AR02 BUILDING MATERIALS & CONSTRUCTION- III

Objective: The course will enable the learning in progression, starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization.

Unit I: Ferrous metals, brief study of cast iron, wrought iron, pig iron and steel; its manufacturing process and properties. Anticorrosive measures for steel, market form of steel for building construction.

Unit II: Non ferrous metals and its various uses in building construction. Steel and aluminium sections for door design (sliding, revolving, openable, collapsible gates, rolling shutters) with fixtures and fittings.

Unit III: Metal casements useful for windows and ventilators.Types of metal casements windows with fixtures, fitting and method of fixing.

Unit IV: Metal casements useful for partitions , fixtures, fitting and method of fixing.

Unit V: Composition of Glass, brief study on manufacture, treatment, properties and uses of glass; special types of glass, sheet glass, safety glass, tinte coated glass, glass blocks, properties and application in the building industry and current developments.

Unit VI: Plastics: Thermoplastic and thermosets properties and architectural uses of plastics, structural plastics, reinforced plastics and decorative laminates, plastic coatings, adhesives and sealants. Primary plastic products for walls, roof, and partitions. Secondary building products for rooms, windows, rooflight,domes,gutters, handrails,etc;

NOTE: Sessionals will be in the form of reports, drawings, and models. Construction site visits are essential for practical exposure.

Sessional work;Assignments and drawing on the above topics.Viva Voce by external examiner at the end of Semester.

References:

1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand,1997

2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. Mckay Building Constrution, vol. 1,2,3, Longmans, U.K.1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

04AR03 HISTOTY OF ARCHITECTURE-III

Objective : History of Architecture exposes the student to evolution of different architectural solutions through historical periods to understand the building materials, construction techniques, planning and designing features.

UNIT-I : Delhi OR Imperial Style. Development of Architectural Style during the Rule of the slave, Khalji, Tuglag, Sayyid & Lodhi Dynastles- important examples for each period.

UNIT-II : Provincial Style: Development of the Provincial Style of different regions- Punjab, Jaipur, Bengal, Gujrat, Malwa, The deccan (bijapur, Golconda, bidar and Gulbarga) – Important Examples for each style with building construction techniques and design elements.

UNIT-III : Mughal Style : Development of the Mughal Style under the different rulers – Humayun, Akbar, Jahangir & Shahjahan- Important Examples for each style with building construction techniques and design elements.

UNIT-IV : Industrial Revolution and it's effect on modern contemporary Architecture. Study of various school of thoughts in Architecture.

UNIT-V : Western Poineer Architects, their philosophy and work : namely Le-Carbourier, Walter Gropuies, F. L. Wright, I.M.Pei, etc.

UNIT-VI : Indian Contemporary Architects and their work, namely- Chales Corea, B.V. Doshi, Raj Rewal, Anant Raje, U.C. Jain, etc.

Sessional work : Assignments and drawing on the above topics.

References:

1. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone press, 1986.
2. Percy Brown, Indian Architecture (Islamic period), Taraporevala and Sons, Bombay, 1983
3. Satish Grover, The Architecture of India (Buddhist and Hindu Period), Vikas Publishing Housing Pvt. Ltd., New Delhi, 1981
3. Christopher Tadgelli, The History of Architecture in India from the Dawn of Civilization to the end of Raj, Longman group, U.K.Ltd., London, 1990

04AR04 APPLIED CLIMATOLOGY- II

Objective: The course aims to understand the various features to be considered for planning and designing of climate responsive built and un-built spaces.

UNIT-I : Introduction of planning, designing, materials and techniques considered in traditional structures with respect to climate to achieve comfortable living conditions.

UNIT-II : Impact of Micro and Macro climatic conditions on built and un-built spaces.

UNIT-III : Thermal properties of traditional and modern building materials and its comparative analysis. Appropriate planning and construction techniques to achieve comfort level in indoor and outdoor spaces.

UNIT-IV: Solar chart and its use, shadow angles, use of shadow angle protractor; types and design of shading devices. Heliodon & its use.

UNIT-V: Day light factor; effect of size and shape of opening for day light, orientation of Fenestration. Ventilation systems.

UNIT-VI: Planning and design of building by considering Passive Cooling and heating; Shadow effects, Orientation, Fenestrations, day light, micro climatic features, wind directions, sunpath diagrams, cavity walls, cross ventilations, stack effect, reverse stack effect etc. to achieve climate responsive design solutions.

Sessional work : Assignments and test on the above topics.

References:

1. O.H.keonigsberger; T.G. Ingersoll and others; Manual of tropical housing and building- Part-I; Longmans,London-1980
2. M. Evans; Housing, climate and comfort; Architectural press London-1980
3. B.G.Givoni; Man,climate,and architecture; Applied science, banking, Essex, 1982
4. N.K Bansal and others; Passive building design; Elsevier science-1994.
5. S.Drake; The third skin architecture,technology and environment; UNSW –press-2007.

04AR05 ARCHITECTURAL STRUCTURE-II

Objective: Understanding of Basic Theory and principles of structural analysis and structural properties of elements.

UNIT-I : Fixed beams with concentrated load and uniformly distributed load (over complete span.)

UNIT-II: Continuous beams (without settlement) with uniform sections by three moments. Only vertical load and uniformly distributed load over whole span by theorem of three moments.

UNIT-III: Moment distribution method for symmetrical portal frames with symmetrical load. Only point load and uniformly distributed load over whole span.

UNIT-IV: Understanding and identification of location of forces, bending moment and bending stress in fixed beam, over hanging beams, continuous beams, Portal frames etc.

UNIT-V:
a) Design procedures for simple load bearing foundations.
b) Failure of foundations systems.
c) Improvement of soil properties.

Sessional work :
Assignments and tutorials on the above topics.

Reference :

1. P.C.Punmia, Strength of Materials and Theory of Structures; vol I, Laxmi Publications, Delhi 1994.
2. S.Ramanmurtham, Strength of Materials – Dhanpatrai & Sons, Delhi 1990
3. W.A.Nash, Strength of Materials – Schaums Series – McGraw Hill Book Company, 1989
4. R.K.Bansal – engineering Mechanics and Strength of Materials – Lakshmi Publications, Delhi, 1990.

04AR06 ARCHITECTURAL DESIGN STUDIO – IV

Sessional work :

Assignments and drawing on the above topics given in the subject 04AR01 ARCHITECTURAL DESIGN – IV. Viva Voce by external examiner at the end of Semester.

04AR07 BUILDING MATERIALS & CONSTRUCTION STUDIO - IV

Sessional work :

Assignments and drawing on the above topics given in the subject 04AR02 Building Materials & construction – IV. Viva Voce by external examiner at the end of Semester.

04AR08 COMPUTER GRAPHICS STUDIO- II

UNIT-I: Productivity tools : Introduction to tools of productivity – blocks, slide facilities, scriptfiles, attributes Understanding concepts of V.port, concept of object linking, and editing session.

UNIT-II: Introduction to 3D Drafting : Introduction to 3D modeling technique and construction planes, drawing object, 3D surfaces setting up elevation and thickness, and use of dynamic projections. Solid modeling, with driving primitive command and Boolean operation. Use of region modeling solid modife.

UNIT-III: 3D Rendering and setting : Rendering and scene setting to create a photo realistic picture understanding material mapping, environment setting and image filing. Construction of any object or building using above said utilities.

Sessional Work : It includes assignments incorporating the use of CAD in form of drawings. Conversion of 2D drawing of previous semester to 3D using softwares like, Autocad, Sketchup, revit, 3D Max. etc. and presentations through photoshop, Power Point etc.

Viva Voce by external examiner at the end of Semester.

04AR09 WORKING DRAWING-I

Objective : The students shall impart the knowledge of construction details for the execution of building from foundation to roof level.

Contains : Working drawing of load bearing masonary structure for design project done during third semester. The drawing should be in an appropriate scales.

The working drawing should include from foundation level to roof level as follows :

a) Muncipal drawing and detail of all level plans.
b) Detail section showing toilets, Staircase and levels of floors.
c) Working detail of toilet, staircase.

d) Working details of any interesting features in the plan, sections & elevation.

e) Site plan showing drainage layout, landscape layout, internal roads etc.

f) Working details of water supply & electrical layout plan's.

Sessional Work : Assignments and drawing plates on the above topics. Viva Voce by external examiner at the end of Semester.

Suggested text books:

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals Edward d Mills- Planning the Architects Hand Book – Bitterworth, London, 1985.
4. Watson,D (editor) Time –saver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.
5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G., "Form defining strategis: experimental architectural design". Wasmuth, 2007.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS PRESCRIBED FOR
FOUR YEAR DEGREE COURSE IN
BACHELOR OF TEXTILE
ENGINEERING
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)
SEMESTER : THIRD

3 TX 01 YARN MANUFACTURING -I

SECTION A

Unit I : **COTTON HARVESTING & GINNING**

Cotton Harvesting: Methods of cotton harvesting, Hand Picking, Machine Picking, Advantages & disadvantages of Hand Picking, Machine Picking. Precautions to be taken while Picking & Storing etc. Trash: its classification, occurrences, Adversity in process and its effect.

Ginning: Objectives of Ginning, Methods of Ginning, Introduction to Roller Gin, Knife roller Gin. Machine and Process parameters in ginning, Pressing and Bailing Process, Developments in Ginning machines.

Unit II: **BLOWROOM:** Brief out line of spinning departments and their objects, Objects of mixing, conventional and modern methods of mixing, Principle & working of mixing machine.

History and developments of blow room lines, Study of different blending methods and their advantages and disadvantages, problems in blending of manmade fibres with cotton, objects of blow room line, various types of modern openers and beaters with their construction and working , comparison of beaters and openers.

Unit III : Lap forming mechanism, Lap measurement mechanism , piano feed regulating motion, calendar roller pressure system, lap rack pressure system and mechanism of auto feeding ,condensers and cages used in blow room line, Material transportation system used in blow room line, Nature of waste extracted in various openers' and beaters ,lap rejection causes remedies , CV% of lap and its importance.

SECTION B

Unit IV : Calculation pertaining to production, cleaning efficiency and blow room efficiency under normal mill conditions, Brief out line of blow room lines setting for both the fibres cotton as well as manmade, Humidification and conditioning of mixing in blow room, Introduction of chute feed systems, types of chute feed system and their working, degree of opening and cleaning of chute feed system, comparative study between chute feed and lap forming system.

Unit V : **CARDING:** Necessity & Objects of carding, Operations involved in carding, Fundamental actions in carding, Detail study with construction and working of carding machine, Various sections of carding machine. India roll and cross roll verga unit, Types of card clothing and their significance and effects. Theories of carding action, Analysis of flat actions and carding force. Introduction to Stripping, Grinding and Burnishing operations. Continuous Feed Vs Lap Feed.

Unit VI : Various settings of card, It's influences on carding quality & production. Transfer mechanism of fibres, Web stripping mechanism, Analysis of stripping process, Consolidation of web into sliver, Trumpet & Calender roller condensation. Parameters affecting Settings, Quality and Production. Concept of draft, Types of Draft, Distribution of draft, Actual and Mechanical draft. Card drive & calculations related to Efficiency, Production of carding machine**.** Carding faults and their origin.

Text Books

1. Spun yarn technology, volume I, Blow room processes - A.Venkattasubramani.
2. Spun yarn technology, volume II, carding - A.Venkattasubramani.

References

1. Technology of Carding – R. Chattopadhyay, NCUTE Publication
2. A practical guide to opening and carding- W .Kein.
3. Khare A R, "Elements of blow room", Sai book center, Mumbai, 1999.
4. Khare A R "Elements of carding", Sai book Centre, Mumbai, 1999.
5. Salhotra K R, "Spinning of Man Mades and Blends on Cotton System", The Textile Association of India, Mumbai, 1989.
6. Chattopadhyay R and Rengasamay R, "Spinning: Drawing, Combing and Roving", NCUTE-Pilot Programme, 1999.

7. Lawrence C A, "Fundamental of Spun Yarn Technology" CRC Press, USA,2003.
8. Oxtoby E., " Spun Yarn Technology ", Butterworth, London, 1987.
9. Klein W., " The Technology of Short-staple Spinning ", TheTextile Institute, Manchester, 1998.
10. Klein W., " A Practical Guide to Opening and Carding ", TheTextile Institute, Manchester, 1999.
11. Lord P.R., " Yarn Production : Science,Technology and Economics ", The Textile Institute, Manchester, 1999.

3 TX 02 FABRIC MANUFACTURING-I

SECTION 'A'

UNIT-I : Classification of different fabric forming systems. Brief outline of process involved in fabric forming by weaving.

Winding :-Objectives, Objectionable faults in yarn and its classification as per uster classimate, Classification of winding process.

High speed winding machines:- Study of various types of creels, tensioners, yarn clearers, traverse motions, thread stop motion, full package stop motion, and anti patterning devices, and calculation regarding high speed winding machines.

UNIT-II : Automatic cone and cheese winding machine:-Construction, working, salient features, creeling unit- balloon controller, Snarl prevention, circular magazine, central unit-tension regulation, splicer, electronic yarn clearer, automatic package doffer, cleaning and dust removal system, internal machine and between machine material flow, advantages and calculation.

Weft winding: -necessity and objective, direct and indirect wefts supply system.

UNIT-III : Construction, working, advantages and calculation regarding:- conventional weft winding machines, modern automatic high-speed weft winding machine and unifill loom winder.

Warping:- necessity, objective and types of warping process, construction, working, advantages, disadvantages and calculation regarding beam warping and sectional warping machine. Modern developments in creel, tensioners, stops motions, head stock and drive of warping machines.

SECTION 'B'

UNIT-IV : Sizing: -necessity and objectives, construction, working, advantages, disadvantages and calculations regarding: Slasher sizing and multi cylinders sizing machine.

Study of types of creel, unwinding tension control system, sow boxes, yarn drying methods and it's equipments. Head stock-lease rod, comb, cut marking motion, beam pressing motion.

UNIT-V : Modern development in Sizing: - limitation of conventional sizing, necessity of modernization and their effect on quality and production of sized warp, driving arrangement of sizing machine-orthodox type drive, slow motion, friction clutch.

Control on sizing machine - size level Control, temperature control, moisture measurement and control, stretch control.

UNIT-VI : Sizing Ingredients:-study of different sizing ingredients with respect to their properties, method of preparation, different requirement of cooking of size paste and method of tests.

Size pick-up-optimum size percentage, factor affecting size pick-up and control.

Type of sizing-heavy, medium, light and pure sizing Size recipe for yarn of polyester, PC, PV blend, sizing calculation-regarding weight of warp, size mixture size consumption, sizing production and efficiency.

Text Books

1. Yarn Preparation (Vol-1 And 2) By R.Sengupta
2. Sizing Method, Material And Mechanism By D.B.Ajgaokar Andtalukdar.

Reference Book

1. Weaving Calcutions By R. Sengupta
2. Textile Mathematics (Vol-3) By J.E.Booth
3. Weaving Technology And Operation By Allan Armored Andwalter S Sondhelm.
4. Weaving Technology By N.M.Kulkarni
5. Weaving Machine Mechanism And Material By M.K.Talukdar.

3 TX 03 **TEXTILE FIBRE-I**

SECTIONA

Unit I : Definition of fibre, textile fibre, staple fibre continuous filament, yarn and thread. Classification of fibers, essential and desirable properties of textile fibers, characteristics of fibre forming polymer, concepts of molecular weight, degree of polymerization, orientation and crystallinity, advantages and disadvantages of natural & manmade fibers.

Unit II : Vegetable Fibers: i) Cotton - Development of fibre in seed, morphological structure, physical, chemical and biological properties, applications. ii) Introduction to other vegetable fibers like hemp, ramie, banana, pineapple fibers: their distinctive features and applications.

SECTION B

Unit III : Vegetable Fibers: i) Jute- retting and extraction process, structure of jute fibre, physical, chemical and biological properties, applications ii) Flax- Retting and extraction process, structure of flax fibre, physical, chemical and biological properties, applications.

Unit IV : Animal Fibers: Wool- Types of wool, grading of wool, morphological structure, chemical composition, physical, chemical and biological properties, applications. ii) Silk - Types of silk, production of silk, chemical composition of silk, physical, chemical and biological properties, applications. iii) Introduction to other animal fibers like, mohair, camel, alpaca. Their distinctive features and applications.

Unit V: Man Made fibres:- definitions of regenerated & synthetic fibres, Introduction to methods of fibre formation – melt spinning, dry spinning and wet spinning. Regenerated fibres: i)Viscose rayon: Manufacturing, physical, chemical properties and applications, ii) High wet modulus and polynosic rayon: manufacturing, properties and end uses,

Unit VI : Cuprammnium rayon: Manufacturing, Physical & chemical properties, and applications. ii) Acetate & Triacetate fibres: manufacturing, physical and chemical properties and End uses.

Text Books

1. Textile Fibres – Vol.-I by V.A.Shenai

2. Fibre Science And Technology by S.P. Mishra

Reference Books

1. Hand book of Textile Fibres Vol. I & II by Gordon & Cook.
2. Textile Fibres by H.V.S. Murthy
3. Man Made Fibres – R.W. Moncrieff.
4. Polymer science- V.Gowariker
5. Textile Science- Gohl and Vilensky

3 TX 04 MACHINE DRAWING

SECTION – A

Unit I : Latest L.S.I. Convention s covering the standard practice in machine drawing. Use of specification for limits and fits.

Unit II : Preparation of freehand proportionate sketches of keys, cotter joints, Couplings.

Unit III : Development of surface of cubes , prisms, cylinders, pyramids, Cones, etc.

SECTION – B

Unit IV : Preparation of freehand proportionate sketches of various machines elements such as rivets and rivets joints, welded joints, bearing and bearing mounting.

Unit V : Principles, procedure and preparation of detail drawing.

Unit VI : Principles, Procedure drawing, preparation of assembly drawing and part list for simple machine assemblies.

Text Books :-

1) Machine Drawing By Bhatt & Panchal.
2) Machine Drawing By M. Agrawal & R. Garg.

References Books :-

1) Machine Drawing By R. K. Dhawan.
2) Machine Drawing By N. Sidheswar,P. Kannaiah,VVS Sastry

3 TX 05 THERMAL SCIENCE AND AIR CONDITIONING

SECTION A

UNIT I : Properties of Steam :Enthalpy of water, sensible heat, latent heat, enthalpy, entropy, internal energy, and specific volume of wet , dry and super heated steam, Distinction between vapour and gas, use of steam table, and miller chart, Dryness fraction & measurement of by separating, throttling, and combine calorimeter.

UNIT II : STEAM BOILER :Simple layout of thermal; power plant, Study of construction of the fire tube and water tube boiler such as Cochran, Cornish, Lancashire, and Babcock and Wilcox boiler. Equivalaent evaporation and efficiency of boiler, calculation of chimney height.

UNIT III : Boiler mounting and accessories :-Saftey valves, stop valves, pressure gauge, water level indicator, feed check valve, blow of valve, and fusible plug, super heater, economizer, air preheater.

SECTION B

UNIT IV : Air Compressor : Classification, Cycle of operation, use of compressed air, pneumatic system, study of various pneumatic circuit, & its component, like valves filter, regulator, accumulator, lubricator.

UNIT V : Refrigeration & Psychometry. Different refrigerant & their properties, Various refrigerant system,.Basic psychometric terms (DBT,WBT,DPT,SH,RH,AH), various psychometric processes, Heating, Cooling, Humidification, Dehumidification. Bypass factor, sensible heat factor. Use of psychometric chart. (Numerical related to psychometric).

UNIT VI : Air Conditioning and Distribution System :Central, Unitary, District, Self-contained AC System. Direct expansion, all water, all air combined, constant volume, variable volume, constant temperature, Induction system.Duct design & Air distribution system.

Text Books

1) A course in Refrigeration and Air Conditioning – S. C. Arora, S. Domkundwar. (Khanna Publication.)
2) Thermal Engineering - P. L. Balaney. (Khanna Publication)

References Books

1) Refrigeration & Air Conditioning – P. N. Ananthnarayanan. (TMH Publication)
2) Elements of Heat Engine – R. C. Patel, C. J. Karamchandani. (Charter Publication)
3) Thermal Enginneering B. K. Sarkar. (TMH Publication)
4) Thermal Engineering - S. Domkundalwar. (Khanna Publication)

3 TX 06 Yarn Manufacturing I-Lab.

8 to 10 Practicals based on syllabus of 3 TX 01

3 TX 07 **Fabric Manufacturing I-Lab.**

8 to 10 Practicals based on syllabus of 3 TX 02

3 TX 08 **Machine Drawing-Lab.**

Eight Practicals based on syllabus of 3 TX 04

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SEMESTER : FOURTH

4 TX 01 YARN MANUFACTURING -II

SECTION A

Unit I : DEVELOPMENTS IN CARDING

Development in carding with reference to licker-in opening region, importance setting of deflector plate, fibre retriever ,modifications and development in carding back zone ,front zone, different attachments in carding particularly for maintenance point of view, detail study of modern high production cards. Card autolevellers-Principles, Types, Advantages & disadvantages. Control of different waste in carding, fibre neps and their assessment, waste extraction system, suctions points in carding, microprocessors used in carding related to MIS.

Unit II : **DRAWFRAME**

Introduction, objective of draw frame, operating principle; Attenuation (draft): the draft, the drafting operation, drafting force; behavior of the fibres in the drafting zone, friction fields, nature and role of fibre friction in drafting, distribution of draft, additional effects of draft; perfect and real drafting; nature of drafting irregularities; coiling- delivery, condensing, sliver coiling, can changing.

Unit III : **DRAWFRAME**

Drafting force in relation to other parameters- Draft ratio, Roller Setting, Fibre Crimp, sliver density. Roller lapping tendency, Selection of creel and web tension draft. Monitoring and auto leveling: structure of computerized data collection and monitoring systems; Blending at the draw frames: conventional & unconventional operations. Production calculations.

SECTION B

Unit IV : **COMBING PREPARATORY**

Objects, need , different types of passages used. Preparation for combing: outline, operating principles of sliver lap machine, ribbon lap machine, sliver doubling machine and super lap machines; comparative assessment of web doubling and sliver doubling processes**,** Systems of lap preparation configuration of fibre feed and its effect on the quality of product, calculation regarding gearing, draft, production of sliver lap ribbon lap and super lap machines

Unit V : **COMBING**

Combing: Object of combing, introduction, tasks of comber, types of comber, sequence of operation in a rectilinear comber; Technology of combing: parameters influencing combing operation- raw material, material preparation parallelization of fibres in the sheet, sheet thickness (wt.), evenness of the lap sheet, disposition of hooks, degree of combing, noil percentage and fractionating efficiency of comber.

Unit VI: **COMBING**

Combing machines: outline, classification, description of functions- feed, feed of lap sheet, feed device, nipper assembly, cylinder comb, top comb, take-off & the material, piecing, withdrawal of the web and formation of sliver, sliver take-off, drafting arrangement, coiling of sliver, waste removal (stripping), timing diagram of comber motions, automation in comber.

Detailed setting of comber machine and gauges used for setting. Gearing, drafts and production calculation of combing machine.

Text Books

1. Spun yarn technology, volume II, carding - A.Ventasubramani.
2. Chattopadhyay R and Rengasamay R, “Spinning: Drawing, Combing and Roving”, NCUTE-Pilot Programme, 1999.

References Books

1. Khare A R, “Elements of combing”, Sai book center, Mumbai, 1999.
2. Khare A R “Elements of carding”, Sai book Centre, Mumbai, 1999.

3. Salhotra K R, "Spinning of Man Mades and Blends on Cotton System", The Textile Association of India, Mumbai, 1989.
4. Lawrence C A, "Fundamental of Spun Yarn Technology" CRC Press, USA,2003. Oxtoby E., "Spun Yarn Technology ", Butterworth, London, 1987.
5. Klein W., " The Technology of Short-staple Spinning ", TheTextile Institute, Manchester, 1998.
6. Klein W., " A Practical Guide to Opening and Carding ", TheTextile Institute, Manchester, 1999.
7. Spinning of Manmades and Blends on Cotton System, K. R. Salhotra
8. Technology of Carding – R . Chattopadhaya NCUTE Publication
9. Advances in Yarn Production - R . Chattopadhaya NCUTE Publication.

4 TX 02 FABRIC MANUFACTURING II

SECTION-'A'

UNIT-I : Looming: - Working principle of leasing ,including Uster automatic leasing ,drawing in and Reaching in , Warp Knotting and Drop planning. Types of healds and reed and their numbering system.

Fabric formation by weaving- details classification of motions, types of sheds.

Tappet shedding mechanism-Negative and positive tappet shedding, movement of healds, geometry of warp shed ,heald reversing motion principles, split shedding and asymmetrical shedding.

UNIT-II : Shuttle picking and checking mechanism, overpicking and under picking mechanisms, Shuttle box and shuttle checking devices- ideal checking, movement of shuttle during picking, disadvantages of shuttle picking.

Beat up mechanism- eccentricity of sley, mechanics of beat up, bumping condition.

Take up and negative let off motion.

Calculation regarding - average reed space, average pick, efficiency and production, shuttle movement.

UNIT-III : Automatic loom:-limitation of plain loom, introduction to automatic loom, types of automatic loom, characteristics, feature of automatic Loom.

Weft fork- Side and centre weft fork motion warp protector motion, temple devices, and timings of plain loom.

Weft filling - mechanical electrical, photo electrical type. Pirn changing weft repulsing motions - essential attachments, mechanisms, shuttle box, rotary magazine, reserve bunch of weft. Northop's and Ruti C pirn changing mechanism, shuttle eye thread cutter , three try motion , timing and setting of pirn changing loom .

SECTION 'B'

UNIT-IV : Warp stop motion - Electrical, mechanical vibrating bar and Castelleted types. Knock of mechanism.

Shuttle changing loom - Vicker staford, Toyada shuttle changing mechanism, bobbin loader automatic loom winder. Automatic let off, tension control and positive take up on Ruti-C Machine.

UNIT-V: Fancy Weaving:- Visual effect of fabrics extra thread effect , colour weaving effect , colour and weave effect .

Multiple box motion - Drop box and circular box, pick and pick and pick at wheel box motions.

Dobby shedding - Classification of dobbies, left and right hand keighley dobby .Method of pegging legs. Cross border dobby Modern dobbies - Cam dobby, paper card dobby, positive dobby, rotary dobby.

UNIT-VI : Jaquard shedding- classification of jacquards, principle parts of jacquard shedding, S.L.S.C., D.L.D.C., D.L.S.C., Open shed, cross border, fine pitch (vencenzi and verdol), electronically conrol jaquard machine.

Loom faults-Reed marks, shuttle flying out, Loom stopping, shuttle trapping in the warp, Loom banging- off weft cutting , Bumping, Cop knocking off.

Fabric defects and value loss - Grading of fabrics, fabric defects such as warp defect, weft defect their causes and remedies.

Text Books

1) Weaving Machine, Mechanism Management By D.B.Ajagaonkar And M.K.Talukdar

References Books

(1) Weaving Operation by Allen Armorod

(2) Fancy Weaving by K.T. Aswani
(3) Weaving Mechanism vol.II by N.N.Bannarji
(4) Principle of weaving by R. Marks and A.T.C. Robinson

4 TX 03 APPLIED ELECTRONICS & CONTROL SYSTEMS

SECTION A

Unit I : Static charge generation & measurement. Types of materials, conductors, insulators and semiconductors P-Type and N-type semiconductors, P-N junction diode principle. Diode as rectifier, Full wave rectifiers, Zener diode and its use as regulator. Theory of special semiconductor devices like FET, UJT, SCR, DIAC, TRIAC (basic principles and working)

Unit II : Transistor principles, PNP, NPN Transistor, its use as amplifier (CE mode only), oscillators (Heartley, colpitt, phase shift & wien bridge) multivibrators using transistor (Astable, monostable and bistable) Basics of operational amplifier.

Unit III : Study of logic gates (7400 series) flip-flops, study of basic Digital counters (Asynchronous and synchronous), shift register, ADC/DAC, Study of Intel 8085 CPU, General block diagram, Interfacing devices (PPI 8255), its application in speed control, temperature control.

SECTION B

Unit IV : Photoelectric devices : LDR, LED, LASER principles, photodiode, photo transistors, photoelectric relay, photovoltaic cells, photo conductive cells (Introductory aspects) LCD, 7. Segment display.

Unit V : Transducers : Types of transducers active, passive & primary, secondary, electrical and non-electrical, capacitive transducers, inductive transducer, measurement of temperature, pressure measurement of flow, thickness, humidity, strain, displacement.

Unit VI : Open loop, closed loop control system, position and speed control mechanism. Principles, working and characteristics performance of control systems and components for following (Mechanical, Hydraulic, Pneumatic and Electric types) a) Position b) Velocity c) Temperature d) Preure e) Flow f) Level, Automatic speed control systems in prime movers, types of analysis of performance characteristics.

Text Books

1. Principles of Electronics : V. K. Mehta

References Books

2. Integrated Electronic : Millman Halkies
3. Modern Digital Electronics : R. P. Jain
4. Introduction to Microprocessors : B. Ram
5. Microprocessor, Architecture and applications : Gaonkar
6. Electrical Measurement : A. K. Sawney
7. Instrumentation : Rangan Sharma
8. Control System : Nagrath Gopal
9. Automatic Control Engineering : B. C. Kuo.

4 TX 04 TEXTILE FIBER- II

SECTION A

Unit I : Synthetic fibers: heterochain and carbon chain fibres, theoretical background, addition, condensation polymerization. i) Polyamide: nylon 6 & nylon 66 fibres – raw material, manufacturing, physical & chemical properties, applications. ii) Polyester (polyethylene terepthalate): raw materials, manufacturing, physical & chemical properties, applications.

Unit II : Synthetic fibres: i) polyacrylonitrile fibre: acrylic and modacrylic fibres - manufacturing, physical & chemical properties, applications. ii) polyvinyl alcohol and polyvinyl chloride fibres: manufacturing, physical & chemical properties, applications. iii) polyethylene & polypropylene: manufacturing, physical & chemical properties, applications.

Unit III : investigating structure-idea of infrared spectroscopy, x-ray, electron microscopy, NMR etc; Microstructure and macrostructure of fibres: Recapitulation of crystalline and non-crystalline materials –structure of crystals, polymer crystals, X-ray diffraction and crystallinity, thermal analysis of polymers by DTA, TGA and DSC.

SECTION B

Unit IV : Investigating fibre structure (a) microstructure and macrostructure of natural fibres: cotton and other vegetable fibres; silk, wool and other animal fibres. (b) microstructure and macrostructure of synthetic fibres: polymer crystallization from the melt or concentrated solution, fibre formation, microstructure of manmade fibres; idea of simple models of fibre structure.

Unit V : (a)Fibre length: (Brief treatment without testing procedure) fibre length variation, technical significance of fibre length. (b) fibre cross-section and linear density: (brief treatment without testing procedure) fibre linear density, fibre cross-sectional shape and surface area, variability in fibre denier; technical significance of fibre fineness; maturity of cotton.(c) environmental effects: (brief treatment without testing procedure): Solvents, moisture and radiation, solubility parameters, Interaction of fibres with moisture, : moisture regain and content, heat of moisture sorption, physical property changes with moisture uptake; idea of the effects of radiation on fibre structure and properties.

Unit VI : Mechanical Properties: a)tensile properties: (brief without trsting procedure) basic definition: true stress, specific stress, tenacity and breaking length, recapitulation of elastic and plastic deformation, Hook's law and poisson's ratio; stress-strain curves, b) elastic recovery, strain recovery, work recovery: shear, bending, torsion and compression physical properties: optical properties, thermal properties, fibre friction , dielectric and effect of static electricity.

Text Books

1. Textile Fibres by H.V.S. Murthy
2. Man Made Fibres – R.W. Moncrieff.

References Books

1. Fiber Science by Steven B. Warner,
2. Physical Properties of Textile Fibres by W.E. Morton and J.W.S. Hearle,
3. Hand book of Textile Fibres Vol. I & II by Gordon & Cook.
4. Investigation of Physical Properties of textile fibres- Hearle & Meredith.
5. Textile Science- Gohl and Vilensky

4 TX 05 GARMENT MANUFACTUING TECHNOLOGY

SECTION-A

Unit I : Basics of Apparel production – Brief outline of process involved in garment manufacturing. Cutting room: Importance of cutting,

production processes in cutting room. Planning, Spreading, preparation for sewing. Fusing; purpose, fusing process, fusing machinery. Sewing room: stitches, seams, feed systems. Accessories in apparels: buttons, zips, underlining, weddings, labels and ornamental materials

Unit lI : Basic Pattern marking : Measurement taking- Size chart and Measuring of Sizes. Definition of various garments parts & positions. Method: bespoke method & industrial Method (Using Blocks) - Basic block construction - block preparation & correction. Standards norms for different size fit.

Unit III : Drafting: Basic principles & methodologies used to draft standard size block patterns for men, women & kids wear viz, shirts,Pants, blouses, jackets, dresses etc.

Drafting of Sleeve & Collar: - Construction of sleeve block - crown height and its relationship with fit of garment. Types of sleeves. Mounting of sleeve, Method of application. Types of collars, classification. Yokes: Definition, Selection of yoke design, different style of yoke. Plackets: different types of plackets. Computer aided drafting.

SECTION-B

Unit IV : Basic Sewing Techniques:-Seams: definition. Types of seams, seam quality, seam performance, factors to be consideredin the selection of seam, seam finishes, seam defect. Stitches: definition, stitch classes, stitch parameters, factors to be considered in the selection of stitches. Stitching defects. Sewing Thread: Types, construction, sewing thread quality, selection of sewing thread. Sewing needles, machinery and equipments.

Unit V : Pressing Technology: Object, classification, means, components, machinery and equipments, handling systems and boiler room. Garment finishing & Inspectios: Attaching buttons, marking, cleaning ,final touch, fitting quality, viewing of garments and quality standards.

Unit VI : Production Technology: Manual systems, making through, section systems, Progressive bundle systems, Straight line systems, Mechanical transport systems, Selective conveyor belt systems, Unit production systems, Quick response sewing systems.

Text Books

1) Garment Technology for fashion designers by Gerry Cooklin.
2) Introduction to clothing manufacturing by Gerry Cooklin**.**

References Books :

1) Clothing Construction and Wardrobe Planning by Dora S. Lewin, Mabel Goode Bowers, Manetta Knttunen- The Macmillan Co New York.
2) Garment technology by Dr. V. Subramanian- Winter School Booklets 1990
3) BIS Publications 1989.

4 TX 06 **Yarn Manufacturing II-Lab.**

8 to 10 Practicals based on syllabus of 4 TX 01

4 TX 07 **Fabric Manufacturing II-Lab.**

8 to 10 Practicals based on syllabus of 4 TX 02

4 TX 08 **Applied Electronics & Control Systems-Lab.**

8 to 10 Practicals based on syllabus of 4 TX 03.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABI PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF TECHNOLOGY
CHEMICAL ENGINEERING
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 CH 01/3 PE 01 APPLIED MATHEMATICS-III / MATHEMATICS-III

1. Prerequisite of Subject
   Engineering mathematics I and
   Engineering mathematics II
2. Objectives of Applied mathematics III. On Completion of the students are expected.
   - To understand Fourier transform & Z-transform, Laplace transform & their application to engineering problems.
   - To know probability and probability distribution.
   - To understand Numerical analysis.
   - To know vector Clarks &their application.

SECTION-A

UNIT –I: Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (7 Hrs.)

UNIT-II: Laplace transforms:
Definition, standard forms, properties of Laplace transform, Inverse Laplace transform, Laplace convolution theorem, Laplace transforms and Unit step function, Solution of Linear differential equations. (7 Hrs.)

UNIT-III: Probability & Probability Distribution
Probability: definition, axioms of mathematical probability, complementation rule, Theorem of total probability, Theorem of compound probability, Independent Events, subjective probability, Baye's Theorem, Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (7 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :-

Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic conjugate functions, Milne's method, singular points, expansion of function in Taylor's and Laurent's series, Cauchy's integral theorem and formula, Residue theorem.

(7Hrs.)

UNIT-V: Numerical Analysis:

Solution of algebric and transcendental equations by method & method of false position, Newton-Raphson method Solution of system of linear equations by Gauss Seidal method, Relaxation method. Solution of first order ordinary differential equations by modified Euler's, method Runge - Kutta method.

(7Hrs.)

UNIT-VI: Vector Calculus :-

Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (7Hrs.)

OUTCOMES:

Students are expected to expertise in solving numerical methods, Laplace transform, Fourier Transform & Z-transform

Probability & Probability Distribution and statistics are very useful to them in future curriculum/student.

Complex functions and vector calculus are backbone of future academic curriculum and hence should be in tuch with contents in syllabus.

Design of syllabus is more than sufficient for academic curriculum of student.

Text Books:

1. Higher Engineering. Mathematics by B.S. Grewal, Khanna Publication.
2. A Text Book of Applied Mathematics, Volume-II by P. N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Numerical Analysis- S.S. Sastry.
2. Advancing Engg. Mathematics by E.K.Kreyzig.

3CH02 PROCESS INSTRUMENTATION

Monitoring and control of processes is an important activity of Chemical Engineer. This subject deals with measurement principles of process parameters like temperature, pressure, level flow.

Objectives:

The students will be able:

1. To learn the operating principles, construction and working of temperature, pressure, level and flow measuring devices.
2. To select the most suitable measuring device based on its performance characteristics for specific measuring task.
3. To test, Calibrate, Maintain measuring devices elements.

SECTION A

UNIT-I : Basic method of measurements –Errors in measurements – Types of Errors.

Transducers – definition – classification – Static characterisitics of instruments – Dynamic characteristic. Transmitter –definition – different types. **(8)**

UNIT-II : Temperature measurements: Introduction – Temperature scale – Conventional methods of temperature sensing. Resistance Thermometer Detector (RTD) –Unbalanced Wheatstone Bridge – Direct conversion. Thermistors – Temperature sensing using thermistor – Semiconductor temperature sensor. Thermocouple –Basics of thermocouple – Thermocouple types – Cold junction compensation.Infrared thermometry – Basics of radiation – Emissivity – Methods of sensing –Direct detection – Indirect detection. **(8)**

UNIT-III : Pressure measurements: Introduction – Units of pressure – Types of pressure measurement – Bourdon tube and bellows – SG based pressure sensors –Capacitance type pressure transducers. Low pressure measurements – pirani gauge – Thermocouple gauge – Ionization gauge. **(8)**

SECTION B

UNIT-IV : Basics of fluid flow – Flow meters – Quantum flow measurements, Differential pressure measurement – Principle of the differential pressure flowmeter, Orifice plate, Venturimeter, Flow nozzle, Dall tube, Pitot tube. Variable area flow meter,Magnet Flowmeters – DC Magnetic Flowmeter, Pulsed Magnetic Flowmeter,Permanent Magnet Type Magnetic Flowmeter, AC Magnetic Flowmeter. Positive displacement Flowmeters – Different type of ultrasonic Flowmeter. **(7)**

UNIT-V : Level Measurements – Level transducer with differential pressure sensing –Capacitance based level sensors – Capacitance sensors for conducting liquids –Capacitance sensors for Non – conducting liquids, other liquid sensors – Displacement type level sensor – Ultrasonic type level sensor – Gamma ray level sensor. **(7)**

UNIT-VI : pH measurements – Basic ideas of pH value – Measurement of electrode potentials – Glass electrode – Reference electrode – Calomel electrode – Silver-Silver chloride electrode, Humidity Sensing – Basic ideas of humidity sensing – Humidity measurement by dew point sensing – Humidity measurement using Lithium Chloride. **(7)**

Text Books:

1. Tattamangalam R. Padmanaban "Industrial Instrumentation Principles and Design"
   Springer, 2000.
2. Donald P. Eckman, " Industrial Instrumentation", CBS Publishers, New Delhi,2002.

Reference Books:

1. R.K.Jain, "Mechanical and Industrial Measurements"
   Khanna Publishers, New Delhi, 1999
2. D.Patranabis, "Principles of Industrial Instrumentation",
   Tata McGraw Hill Publishing Ltd, New Delhi, 1999
3. C.D. Johnsons, "Process Control Instrumentation Technology",
   Prentice Hall Inc, 1998
4. A.K.Sawhney, "A Course In Electrical and Electronics Measurement and Instrumentation", Dhanpat Rai and Sons, New Delhi, 1999

3CH03 /3PP03/3CT03 STRENGTH OF MATERIALS

SECTION-A

Unit-I :

1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II :

1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

Unit-III :

1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin cylinders and spherical shells subjected to internal pressures.
Axially loaded columns (Euler's and Rankin's formula).

Unit –V:

1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI : Deflection of beams
Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books:

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Material, Danpat Rai and Sons, New Delhi.

Reference Books:

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material a Practical Approach, First Edition University Press, Hydrabad.

3 CH 04/3 CT 04 CHEMICAL ENGINEERING THERMODYNAMICS-I/ CHEMICAL ENGINEERING THERMODYNAMICS

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work-to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Objective:

After studying this subject the student will have:

1. The mathematical abilities required for applying thermodynamics to practical problems.
2. Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: **BASIC CONCEPTS:** The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule. **(8)**

UNIT-II: **FIRST LAW OF THERMODYNAMICS:** First law of thermodynamics - Types of energy, work, heat and energy changes, enthalpy and heat capacity limitations of the first law, application of first law to different processes. **(8)**

UNIT-III: **SECOND LAW THERMODYNAMICS:** Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder, refrigeration and liquefaction. **(8)**

SECTION B

UNIT-IV: REFRIGERATION AND LIQUEFACTION: The carnot refrigerator, the vapour-compression cycle, comparison of refrigeration cycles, liquefaction processes, heat pump. Rankine power cycle. **(7)**

UNIT-V: THERMODYNAMIC PROPERTIES OF FLUIDS: Property relations for homogeneous phases, thermodynamic diagram, generalized property correlation for gases. **(7)**

UNIT-VI: THERMODYNAMICS OF FLOW PROCESSES: flow of compressible fluids through ducts, compression processes, steam turbines and nozzles, condensors. **(7)**

Text Books:

1. J.M. Smith and H.C. Van Ness, “Introduction to Chemical Engineering Thermodynamics”, McGraw Hill, 1998
2. K.V.Narayanan, .”A textbook of Chemical Engineering Thermodynamics”, Prentice Hall of India Ltd., 2001

Reference Books:

1. Sadler S. I., J, “Chemical and Engineering Thermodynamics” John Wiley and Sons, Inc. New York, 3rd Ed., 1999
2. Elliot J. R. and Lira C.T., “Introductory Chemical Engineering Thermodynamics”, Prentice Hall, 1999
3. Eastop T. D. and McConkey A.,” Applied Thermodynamics for Engineering Technologists’, Addison Wesley Longman Ltd., England, 5th Ed., 1999

3 CH 05/3 PP05/3 CT 05 PROCESS CALCULATIONS

This subject deals with the fundamentals of chemical engineering operations and processes in an accessible style to help the students gain a thorough understanding of chemical process calculations.

The chief objective of this subject is to prepare students to make analysis of chemical processes through calculations and also to develop in them systematic problem-solving skills. The students are introduced the application of law of combining proportions to chemical reactions, also to formulating and solving material and energy balances in processes with and without chemical reactions

SECTION A

UNIT-I: Introduction to Chemical engineering calculations, units and dimensions, mole and molecular weight, properties of gases, vapors, liquids, solutions and solids, gas laws, partial pressures, vapor pressures, saturation and equilibria, Raoults law, partial saturation and humidity. (8)

UNIT-II: Material balances without chemical reactions, stoichiometry and unit operations distillation,absorption, stripping, extraction, leaching, crystallization, drying, and psychrometry. Recycle, purge and bypass calculations. (8)

UNIT-III: Material balances involving chemical reactions, simple oxidation reaction, calculations involving combustion of gaseous, liquid and solid fuels. Recycle, purge and bypass calculations.

Introduction to unsteady state material balances. (8)

SECTION B

UNIT-IV: Energy balance - heat capacity and calculation of enthalpy changes, Enthalpy changes for phase transitions, evaporation, clausius - clapeyron equation. (7)

UNIT-V: Energy balances with chemical reaction - heat of reaction and adiabatic flame temperature calculations. (7)

UNIT-VI: Heating value of fuels. Calculations involving theoretical and excess air, heat and material balances of combustion processes. (7)

Text Books:

1. B.I.Bhatt and S.M.Vora, “Stoichiometry”, Tata McGraw Hill, 3rd Edition, 2004
2. A.Hougen, K.M. Watson and K.A.Ragatz, “Chemical Process Principles”, Vol 1, John Wiley

3CH06 PROCESS INSTRUMENTATION - LAB

List of experiments:

1. Measurement of temperature using thermocouple or RTD or Thermistor and to find their characteristics.
2. Measurement of high temperature using radiation or Optical pyrometer.
3. Measurement of pressure using LVDT or Strain gauge transducer.

4. Calibration of pressure gauge using Dead Weight Tester.
5. Measurement of level using air purge or capacitance type level detector.
6. Measurement of flow using magnetic flow meter or Ultrasonic flow meter.
7. Calibration of thermocouple/Bimetallic thermocouple/Resistance thermocouple.
8. Calibration of Pressure gauge/ Pnuematic pressure recorder/ Differential pressure recorder.
9. Calibration of Orificemeter/ Venturimeter / Rotameter/ Gas flow meter.
10. Estimation of viscosity by Redwood/ Saybolt/ Ostwald viscometer.
11. Calibration of pH meter.
12. Calibration of Conductivity meter.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

3CH07 / 3PP08 / 3CT08 STRENGTH OF MATERIALS-LAB.

Practicals :

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3CH08 / 3CT09 CHEMICAL ENGINEERING THERMODYNAMICS-I – LAB

List of Study Experiments:

1. Study of low temperature refrigeration system.
2. Study of ranking power cycle.
3. Study of steam nozzles
4. Study of steam turbine
5. Study of boiler
6. Study of mounting accessories of boiler.
7. Study of condensers.
8. Study of economizer and superheater.

9. Visit to thermal power station.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be studied by the student to complete the term work.

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SEMESTER : FOURTH

4CH01 FLUID FLOW OPERATIONS

The subject gives the knowledge of fluid flow and various fluid transportations. This knowledge is useful in different subjects to be studied in Chemical Engineering course.

Objectives: After studying the subject student will be able,

1. To distinguish between different types of fluids.
2. To understand the concept of viscosity.
3. To Calculate flow rates.
4. To understand the principles behind different flow meters.
5. To understand the principle and working of different fluid flow machinery.

SECTION A

UNIT I: Properties of fluids and their classification.
Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids. Forces on submerged bodies. Rigid body motion, pressure measurements, Euler's equation. (8)

UNIT II: Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis; Buckingham'sÐ.theorem ; Dimensionless numbers and their physical significance; Similitude criteria. Mixing and agitation of fluid, Types of mixers and their selection; Power requirement. (7)

UNIT III: Fluid flow: Laminar and turbulent flows; Pressure drop in pipes and tubes, pipe fittings and pipe network and friction factor; Conservation of mass, momentum and energy; Navier-Stokes equation; Mechanical energy balance and Bernoulli's Theorem. (8)

SECTION B

UNIT IV: Flow measuring devices for chemical plants: Orifice meter, nozzle and venturi meters, rotameter and pitot tube. (8)

UNIT V: Pumping and compressing of chemicals and gases, reciprocating pumps, rotary pumps, centrifugal pumps and blowers. NPSH and calibration.
Mixing and agitation of fluids. Compressible fluid flow and aerodynamics. (8)

UNIT VI: Flow past immersed bodies, flow through packed bed fluidized bed.
Introductory concepts of two-phase flow. (6)

Books Recommended:

1. McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill
2. Chemical Engineering, Vol. 1, Coulson J. M. and Richardson J. F. Butterworth Heinemann, Oxford.

4CH02 CHEMICAL ENGINEERING THERMODYNAMICS-II

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work-to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Objective:

After studying this subject the student will have:

1. The mathematical abilities required for applying thermodynamics to practical problems.
2. Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: First law of thermodynamics, equation of state, critical properties, Vander Wall's constants, Virial expansions, Redlich-Kwong equation, Beattle-Bridgeman equation.
First law applied to thermodynamic processes and calculations of work, free energy and heat changes. Maxwell relation equation, second law and third law of thermodynamics. Thermodynamics relations based on second law. Relation between Cp and Cv, compressibility factor and coefficient of thermal expansion, concept of residual entropy and entropy of equilibrium. (8)

UNIT-II: Partial molar and apparent molar properties, Gibbs Duhem equation, chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws. (8)

UNIT-III: Colligative properties, Ebulliometric constant. Determination of molecular weight of unknown chemical substances. Solubility law. Vapour liquid equilibrium, T-X-Y diagrams and X-Y diagram for ideal and non ideal system. Raoult's law and Henry's law, Deviations from Raoult's law. Comparison of ideal and non-ideal systems. (8)

SECTION B

UNIT-IV: Phase equilibria in non reacting multi-components, binary and ternary systems. Graphical representation of L/L, L/S and G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Phenol-water systems, Aniline-water-chlorobenzene systems. (7)

UNIT-V: Statistical thermodynamics, thermodynamics probability, its relation with entropy, partition function and its relation with thermodynamic functions, the Boltzman distribution law, Distribution law for chemically reactive system Thermodynamics charts and their uses. Searching of thermodynamics data. (7)

UNIT-VI: Chemical equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, effect of temperature and pressure, Relation between Kp, Kc and Kv, Le-Chatelier's principle. Endo-exothermic reactions. Heterogeneous equilibria, various methods of calculating free enegy charge, equilibrium conversions, case study of feasibility report for manufacture of industrial chemicals. (7)

Text Books:

1. An Introduction of Chemical Thermodynamics: R.P.Rastogi and R.R. Mishra
2. Chemical Engineering Process: Houghen and Watson

Reference Books:

1. Introduction to Chemical Engineering Thermodynamics: J. M. Smith and H. C. Vauhess.

2. Thermodynamics for Chemical Engineering: H. C. Weber and J. P. Meissner.
3. Engineering Thermodynamics: P.K. Nag.

4 CH03 / 4 PP03/ 4 CT03 MACHINE DESIGN & DRAWING

Unit I :

1. **Mechanical Engineering Design :** Traditional design methods, Design process, Design synthesis, Standardisation Limits, Fits and tolerances.
2. **Engineering Materials**: Mechanical Properties of materials I.S.designation of materials, selection of materials.

Unit II :

1. **Design for static and fluctuating loads:** Brittle and due title/Theories of failures, Factor of safety, stress concentration, Fluctuating Stresses, Endurance Limit, Solderberg diagrams, notch sensitivity/Materials.
2. **Shafts & Bearings:** Transmission shafting. ASME Code, Design on the basis of rigidity, Design of keys and couplings. Types of rolling contact bearing. Static and dynamic load carrying capacity, election of rolling contact bearing from manufacturers catalogue.

SECTION-B

Unit III : Bolted, Riveted and Welded joints : Type of rivctted joints, stresses in rivets, Thin cylinders with riveted joints, Types of welded joints, welded and riveted joints subjected to accentric loading. Belted joints.

Unit IV : Belt, Chain and Gear Drivers : Types of belts and Chains, selection of belts and chains from manufactures catalogues.

Uniit V: Types of gears, Gear tooth profiles, Gear train velocity ratios, Gear tooth load for spur, helical level and worm gears, Design of spur gears.

Unit VI : Cylinders and pressure vessels; Thick and thin cylinders, Design of pipe lines and hydraulic vavles. Introduction to design of unfired pressure vessels.

Books Recommended :

1. Mechanical Engineering Design by J.E.Shigley, Mc Graw hill.
2. Design of Machine Elements, by M.F.Spotts, Prentice Hall.

4 CH 04 **APPLIED PHYSICAL CHEMISTRY**

Unit I : Electrochemistry

Ion transport in electrolytes : Conductivity of strong and weak electrolytes, Specific, Equivalent and Molar conductivity, determination of conductivity, Effect of dilution on conductivity, Kohlraush law and ionic mobility , Transport number and their determination , Electrolytic concentration cell with and without transference

Electrical phenomenon at interface : Electrical double layer, electrode potential, Nernst equation, Debye- Huckel's theory of strong electrolyte , electrokinetic phenomenon.

Applications of electrochemistry : Determination of hydrogen ion concentration, determination of pH, Determination of dissociation constant, Determination of solubility & solubility products of sparingly soluble salts , Determination of activity and activity coefficient from equilibrium constant, Numericals

Electrometric titrations : Conductometric and potentiometric titrations, their applications. (10 Hrs)

Unit II : Kinetic theory of gases

Postulates of kinetic theory, derivation of equation of state, Van-der-waal's equation, critical phenomenon, calculation of critical constants from Van-der-waal's equation, Maxwel-Boltzmann's law of distribution of molecular speed, root mean square speed, average speed and most probable speed, Mean free path, collision diameter, collision number and its derivation, Principle of corresponding state,

Unit III : Radiation chemistry and spectroscopy

Radiation chemistry : Photochemical reactions, Lambert's and Beer's law, Law of photochemical equivalence, Quantum efficiency and its determination, Deviation from Stark- Einstein law, photosensitization .

Spectroscopy : Introduction, Types of spectra & different spectral regions, derivation of moment of inertia , energy and wave number for rigid rotator, IR- Spectra, UV- spectra and NMR- Spectra, instrumentation and their applications.

Unit IV : Surface phenomenon and Catalysis

Adsorption , Classification of adsorption, Freundlich isotherm , Langmuir theory of adsorption, BET adsorption isotherm and

its application for determination of surface area of fine powder. Numerical on isotherm and surface area.

Catalysis : Characteristics of catalyst, Homogeneous and Heterogeneous catalysis, mechanism of catalytic action, Enzyme catalyst, Concepts of acid- base catalysis, Contact theory of Heterogeneous catalysis (8 Hrs)

Unit VI : Chemical Equilibrium and Kinetics

Chemical equilibrium : Introduction, law of mass action, equilibrium constants Kp, Kc & Kx, their interrelation .Numericals

Kinetics and molecular reaction dynamics : Concept of reaction rate and extent of reaction , order and molecularity of reaction, rate law for first, second and third order reaction, Kinetics of complex and polymerization reaction, Methods for determination of order of reactions. Theories of absolute reaction rate, Steady state principle, Composites reactions, Chain reactions and fast reactions, energy of activation and its determination. (8 Hrs.)

Unit VI : Thermodynamics

Origin of First law, thermodynamic terms and their definitions, Heat ,Energy and work function Second law, carnot's cycle, heat pump and refrigerator, thermodynamic temperature scale, concept of entropy, Entropy of spontaneous and reversible process, Helmholtz and Gibbs free energy, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partial molar properties, chemical potential,

Third law of Thermodynamics : Entropy and probability, partition functions, Determination of entropy at absolute zero. (8 Hrs.)

Books Recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill

6. Physical chemistry of surfaces, Arthur W. Adamsons, Alice P. Gast, John Wiley publications
7. Principle of Heterogeneous catalysis, J.M.Thomas, W.J. Thomas, John Wiley publications

4CH05 CHEMICAL ENGINEERING OPERATIONS – I (MECHANICAL OPERATIONS)

This subject intends to equip the students with concepts and principles as well as construction of equipments used for handling Mechanical Operations in a chemical plant. This subject gives idea about principles of handling mixtures of solids, liquid and gases. This subject will help students for understanding principles for separation and purification techniques of solid, liquids and gases mixtures.

Objective:

After studying this subject's student will be able to:

1. Explain methods of size reduction and equipments working on those principles.
2. Describe various equipments used for size separation.
3. Identify various other physical properties used for purification solid-solid mixtures and equipments working on this principle.
4. Describe various method of purification of heterogeneous mixture of solid liquid, & equipments like filters, settlers, used for separation of solid liquid mixtures.
5. Identify various types of agitators used for mixing solids-liquids mixtures, power calculation of a mixer.

SECTION A

UNIT-I: 1. Size reduction, stages of reduction, equipment operating variables, laws of energies, energy requirements.
2. Screening: Screen analysis, particle size distribution. (7)

UNIT-II: 1. Classification: Equal falling particles, equipment, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity
3. Sedimentation: Continuous thickners. (8)

UNIT-III: 1. Storage and handling of solids, transportation.
2. Mixing, mixers, agitation, type of equipments. (7)

SECTION B

UNIT-IV: 1. Filtration: Theory, operation, types, flotation agents, flotation cells.

2. Filter calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration- constant pressure and constant rate and their equipments. (8)

UNIT-V: 1. Centrifuges: Theory, equipments, types and calculations.
2. Cyclones: Hydrocyclones, liquid scrubbers and electronic precipitators. (7)

UNIT-VI: 1. Adsorption, theory, type and application, Langmuir's Freund Lich;s equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidized beds.
3. Recent developments in mechanical operations. **(8)**

Text Books:

1. Bedger and Bencharo, "Introduction to Chemical Engineering". Tata McGraw Hill
2. Narayanan C.M. & Bhattacharya B.C. "Mechanical opeartions for chemical engineers", Khanna Publishers. 3 rd Ed.1999

Reference Books:

1. Coulson and Richardson: Chemical Engineering, Vol. 2
2. Brown,G.G. and Associates "Unit operations" Wiley ,New York

4 CH 06 FLUID FLOW OPERATIONS - LAB

List of Experiments:

1. To obtain the coefficient of discharge for the given enturimeter and obtain its relationship with Reynolds' no.
2. To calibrate the given Rotameter.
3. To obtain the coefficient of discharge for the given orifice meter and obtain its relationship with Reynolds' no.
4. To study the flow and determine critical Reynolds no.
5. To determine the discharge co-efficient of the given v-notch.
6. To verify the Bernoulli's theorem.
7. To determine the viscosity of the given liquids using Stoke's law.
8. To determine the viscosity of a given liquid by measuring efflux time of a given tank. Also determine the diameter of a given capillary and compare.
9. To determine relation between friction factor and Reynolds number for the given flowing fluid through circular pipe.
10. To obtain relation between friction factor and Reynolds number for flow of water through annulus.

11. To determine the resistance offered by various pipe fittings and express them in terms of equipment straight pipe length.
12. To study characteristics curves for a centrifugal pump.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4CH07 CHEMICAL ENGINEERING THERMODYNAMICS-II LAB

List of experiments:

1. Critical solution temperature of phenol water system.
2. Critical solution temperature of phenol water system in presence of impurity like NaCl.
3. Critical solution temperature of phenol water system in presence of impurity like succnic acid.
4. Determination of boiling point elevation in presence of impurity.
5. Determination of freezing point depression in presence of impurity.
6. Study of T-X-Y Diagram.
7. Lowering of vapour pressure.
8. Study of boiling point diagram.
9. Study of ternary diagram.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4 CH08 / 4 PP08 / 4 CT07 MACHINE DESIGN & DRAWING-LAB

DRAWING WORKS:

Drawing based on the above syllabus. Atleast four sheets of imperical size are expected.

4 CH 09 Applied Physical Chemistry Lab

Measurement of molecular weight of polymers by viscosity measurement, Heat of neutralization and solution, Hydrolysis of methyl acetate, relative strength of two acids, rate constant with varying concentration of ester, order of reaction between ($K_2S_2O_8$+ KI),Determination of equivalence conductivity of strong electrolytes at infinite dilution, conductometric and potentiometric titrations, Verification of Beer- Lamberts law, solubility of sparingly soluble salts by conductometric and potentiometric measurement, Specific rotation of cane sugar by polarimetry, determination of pH. Determination of refractive index. Determination of energy of activation, Verification of Freundlich and Langmuirs isotherms. Determination of transport number. (Any 10 Experiments)

4CH10 CHEMICAL ENGINEERING OPERATIONS-I LAB (MECHANICAL OPERATIONS)

1. To study the performance of Ball Mill and find out it's crushing efficiency.
2. To study the performance of Jaw Crusher and find out it's crushing efficiency.
3. To study the performance of Crushing Rolls and find out it's crushing efficiency.
4. To study the settling characteristics (Free & Hindered settling) of a given suspension of particles.
5. To study the filtration characteristics of rotary vacuum filter.
6. To study the filtration characteristics of Plate and frame filter press.
7. To study the filtration characteristics of Leaf and sparkle filter.
8. To carry out differential and cumulative screen analysis of given sample of solid particles.
9. To determine energy consumption and crushing law constants for jaw crusher.
10. To determine Critical speed of Ball mill & Average particle size of the product obtained in ball mill, **OR** Average particle size of product obtained in Bhrustone mill.
11. To determine area of batch thickener by conducting batch sedimentation test.
12. To determine efficiency of Cyclone separator.
13. To Determine Variation of size reduction in ball Mill by changing the residence time, size of grinding medium and material of grinding medium.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABI PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF TECHNOLOGY
POLYMER (PLASTIC)
TECHNOLOGY
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3 PP 01 CHEMISTRY AND TECHNOLOGY OF POLYMERS

SECTION-A

Unit I : Introduction to ploymers, classification & types of polymers. Nomenclature. Termoplastics and thermosets. Linear, branches an crosslinked polymer Block and graft copolymer.

Unit II : Manufacture and properties of some important monomers used for commercial production such as ethylene. Propylene, bustadine, styrene, vinylchloride, phenol and M.M.A.

Unit III : Physical and chemical methods of analysis of Monomer and Polymer, Application of IR, NMR, X-ray diffraction HPLC, GLC, TLC to polymer analysis.

SECTION-B

Unit IV : Functionality concept and determination of functional groups. carothers equation and their application principles and distinctive features of polyaddition and polycondensation.

Unit V : Number average and weight average molecular weight and their determination by techniques such as solution viscosities, osmotic pressure, cryoscopic method, end group analysis, ultra centrifigation and kight scatterina.

Unit VI : Chemistry of polymer degradation prevention of polymer degradation and polymer stabilization

- Thermal Degradation - effect of high temp.
- Mechanochemical Transformation and light and ionizing Radition.
- Chemical degradation-Oxidation and degradation by chemical agents.

Books Recommended :

1. Principles of polymerization-G.C.Odlon
2. Text book of polymer chemistry-cliendsivy-Billmever (J.)

3. Kinetic and Mechanism of Polymerization Reactions Allen PEM Patrick C.R. John Wiley,
4. Principles of polymerization Engg.-Biecenbergtr J.A. Sebastian P.H.
5. Text Book of Polymer Science by Dr. Vasant Gowarikar.

3 PP 02 APPLIED PHYSICAL CHEMISTRY

Unit I : **High Polymers (Macromolecules)**
Nomenclature, functionality and classification of macromolecules, Number average and weight average molecular weight of macromolecules , Methods of molecular weight determination , Viscosity measurement, Membrane osmometry, Light scattering , Sedimentation and ultracentrifuge methods, Intrinsically and Extrinsically conducting polymers, Doped conducting polymers and their applications, Effect of polymer structure on properties of polymers, Numerical on molecular weight determination. (6 Hrs)

Unit II : **Electrochemistry**
Ion transport in electrolytes : Conductivity of strong and weak electrolytes, Specific, Equivalent and Molar conductivity, determination of conductivity, Effect of dilution on conductivity, Kohlraush law and ionic mobility ,Electrolytic concentration cell

Electrical phenomenon at interface : Electrical double layer, electrode potential, Nernst equation,Debye- Huckel's theory of strong electrolyte , electrokinetic phenomenon.

Applications of electrochemistry : Determination of hydrogen ion concentration, determination of pH, Determination of dissociation constant, Determination of activity and activity coefficient from equilibrium constant

Electrometric titrations : Conductometric and potentiometric titrations, their applications. (8 Hrs)

Unit III : **Kinetics and molecular reaction dynamics**
Chemical ebuilibrium : introduction, law of mass action, equilibrium constants Kp, Kc & Kx, their interrelation .

Kinetics : Concept of reaction rate and extent of reaction , order and molecularity of reaction, rate law for first, second and third order reaction, Kinetics of polymerization reaction, Methods for determination of order of reactions. Theories of reaction rate, (8 Hrs.)

Unit IV : Phase Ebuilibria in simple system and Catalysis

Gibb's phase rule, derivation and definition of terms involved in phase rule, phase diagram of one component system (water system), Two component system (Bi-Cd system)

Catalysis : Characteristics of catalyst, Homogeneous and Heterogeneous catalysis, Concepts of acid- base catalysis, Contact theory of Heterogeneous catalysis (6 Hrs)

Unit V : Thermodynamics

Origin of First law, thermodynamic terms and their definitions, Second law carnot cycle, heat pump and refrigerator, thermodynamic temperature scale, concept of entropy, spontaneous and reversible process, Helmholtz and Gibbs free energy, Gibbs- Helmholtz equation pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. (6 Hrs.)

Unit VI : Radiation chemistry and spectroscopy

Radiation chemistry : Photochemical reactions, lamberts and Beers law, Law of photochemical equivalence, Quantum efficiency and its determination, Deviation from Stark- Einstein law, photosensitization

Spectroscopy : Introduction, Types of spectra & different spectral regions, derivation of moment of inertia , energy and wave number for rigid rotator, IR- Spectra, NMR- Spectra, instrumentation and their applications.

Thermal analysis techniques of polymers : Thermal Gravimetric Analysis (TGA) , Differential Thermal Analysis (DTA), and Differential Scanning calorimetric (DSC) (8 Hrs.)

Books recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill
6. Polymer chemistry, Gowarikar

3PP03 /3CH03 / 3CT03 STRENGTH OF MATERIALS

SECTION-A

Unit-I :

1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II :

1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

Unit-III :

1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin cylinders and spherical shells subjected to internal pressures.

Axially loaded columns (Euler's and Rankin's formula).

Unit -V :

1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI Deflection of beams

Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books:

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Material, Danpat Rai and Sons, New Delhi.

Reference Books:

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material a Practical Approach, First Edition University Press, Hydrabad.

3 PP 04/3CH04 CHEMICAL ENGINEERING THERMODYNAMICS / CHEMICAL ENGINEERING THERMODYNAMICS-I

Chemical Engineering Thermodynamics is primarily concerned with the application of thermodynamics to phase equilibria and reaction equilibria. It is concerned with the application of Thermodynamics to heat-to-work and work-to-heat conversion devices. Chemical engineers are seriously concerned with the calculation of work in separation and in mixing processes. Its applications are obvious in the design of Chemical engineering equipments in processes.

Objective:

After studying this subject the student will have:

1. The mathematical abilities required for applying thermodynamics to practical problems.
2. Its applications in the design of Chemical engineering equipments in processes.

SECTION A

UNIT-I: **BASIC CONCEPTS:** The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule. (8)

UNIT-II: **FIRST LAW OF THERMODYNAMICS:** First law of thermodynamics - Types of energy, work, heat and energy

changes, enthalpy and heat capacity limitations of the first law, application of first law to different processes. (8)

UNIT-III: **SECOND LAW THERMODYNAMICS:** Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder, refrigeration and liquefaction. (8)

SECTION B

UNIT-IV: REFRIGERATION AND LIQUEFACTION: The carnot refrigerator, the vapour-compression cycle, comparison of refrigeration cycles, liquefaction processes, heat pump. Rankine power cycle. (7)

UNIT-V: THERMODYNAMIC PROPERTIES OF FLUIDS: Property relations for homogeneous phases, thermodynamic diagram, generalized property correlation for gases. (7)

UNIT-VI: THERMODYNAMICS OF FLOW PROCESSES: flow of compressible fluids through ducts, compression processes, steam turbines and nozzles, condensors. (7)

Text Books:

1. J.M. Smith and H.C. Van Ness, “Introduction to Chemical Engineering Thermodynamics”, McGraw Hill, 1998
2. K.V.Narayanan, .”A textbook of Chemical Engineering Thermodynamics”, Prentice Hall of India Ltd., 2001

Reference Books:

1. Sadler S. I., J, “Chemical and Engineering Thermodynamics” John Wiley and Sons, Inc. New York, 3rd Ed., 1999
2. Elliot J. R. and Lira C.T., “Introductory Chemical Engineering Thermodynamics”, Prentice Hall, 1999
3. Eastop T. D. and McConkey A.,” Applied Thermodynamics for Engineering Technologists’, Addison Wesley Longman Ltd., England, 5th Ed., 1999

3 PP05 / 3 CH 05 / 3 CT 05 PROCESS CALCULATIONS

This subject deals with the fundamentals of chemical engineering operations and processes in an accessible style to help the students gain a thorough understanding of chemical process calculations.

The chief objective of this subject is to prepare students to make analysis of chemical processes through calculations and also to develop in them systematic problem-solving skills. The students are introduced the application of law of combining proportions to chemical reactions, also to formulating and solving material and energy balances in processes with and without chemical reactions

SECTION A

UNIT-I: Introduction to Chemical engineering calculations, units and dimensions, mole and molecular weight, properties of gases, vapors, liquids, solutions and solids, gas laws, partial pressures, vapor pressures, saturation and equilibria, Raoults law, partial saturation and humidity. (8)

UNIT-II: Material balances without chemical reactions, stoichiometry and unit operations distillation, absorption, stripping, extraction, leaching, crystallization, drying, and psychrometry. Recycle, purge and bypass calculations. (8)

UNIT-III: Material balances involving chemical reactions, simple oxidation reaction, calculations involving combustion of gaseous, liquid and solid fuels. Recycle, purge and bypass calculations.
Introduction to unsteady state material balances. (8)

SECTION B

UNIT-IV: Energy balance - heat capacity and calculation of enthalpy changes, Enthalpy changes for phase transitions, evaporation, clausius - clapeyron equation. (7)

UNIT-V: Energy balances with chemical reaction - heat of reaction and adiabatic flame temperature calculations. (7)

UNIT-VI: Heating value of fuels. Calculations involving theoretical and excess air, heat and material balances of combustion processes. (7)

Text Books:

1. B.I.Bhatt and S.M.Vora, “Stoichiometry”, Tata McGraw Hill, 3rd Edition, 2004
2. A.Hougen, K.M. Watson and K.A.Ragatz, “Chemical Process Principles”, Vol 1, John Wiley

3 PP 06 CHEMISTRY AND TECHNOLOGY OF POLYMERS-LAB

List of Practicals :

1. Determination of acid value, saponification value, Iodine value, hydroxyl value of polymer.

2. Determination of acetyl value, aldehyde content & functional groups of monomer.
3. Synthesis of Phenol formaldehyde resin ureaformaldehyde resin Hylon-06 polystyrene polyester PMMA.
4. Determination of mole wt. of polymer by end group analysis.
5. Identification of monomers like styrene, M.M.A.

   Other Practicals based on syllabus.

3 PP 07 APPLIED PHYSICAL CHEMISTRY-LAB

Measurement of molecular weight of polymers by viscosity measurement, Heat of neutralization and solution, Hydrolysis of methyl acetate, relative strength of two acids, rate constant with varying concentration of ester, order of reaction between (K2S2O8+ KI),Determination of equivalence conductivity of strong electrolytes at infinite dilution, conductometric and potentiometric titrations, Verification of Beer- Lamberts law, solubility of sparingly soluble salts by conductometric and potentiometric measurement, Specific rotation of cane sugar by polarimetry, determination of pH. Determination of refractive index. (Any ten experiments)

3PP08 / 3CH07 / 3CT08 STRENGTH OF MATERIALS-LAB.

Practicals :

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3PP09 CHEMICAL ENGINEERING THERMODYNAMICS–LAB

List of Study Experiments:

1. Study of low temperature refrigeration system.

2. Study of ranking power cycle.
3. Study of steam nozzles
4. Study of steam turbine
5. Study of boiler
6. Study of mounting accessories of boiler.
7. Study of condensers.
8. Study of economizer and superheater.
9. Visit to thermal power station.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be studied by the student to complete the term work.

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SEMESTER : FOURTH

4PP01 CHEMICAL ENGINEERING OPERATION-I
(Mechanical Operation)

This subject intends to equip the students with concepts and principles as well as construction of equipments used for handling Mechanical Operations in a chemical plant. This subject gives idea ablut principles of handling mixtures of solids, liquid and gases. This subject will help students for understanding principles for separation and purification techniques of solid, liquids and gases mixtures.

Objective :

After studying this subject's students will be able to :

1. Explain methods of size reduction and equipments working on those principles.
2. Describe various equipments used for size separation.
3. Identify various other physical properties used for purification solid-solid mixtures and equipments working on this principle.
4. Describe various method of purification of heterogeneous mixture of solid liquid and equipments like filters, settlers, used for separation of solid liquid mixtures.
5. Identify various types of agitators used for mixing solids-liquids mixtures, power calculation of a mixer.

SECTION-A

Unit I :
1. Size reduction, stages of reduction, equipment operating variables, laws of energies, energy requirements.
2. Screening; Screen analysis, particle size distribution (7)

Unit II :
1. Classification : Equal falling particles, equipment, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity.
3. Sedimentation : Continuous thickners. (8)

Unit III :
1. Storage and handling of solids, transportation.
2. Mixing, mixers, agitation, type of equipments. (7)

SECTION-B

Unit IV : Theory, operation, types, flotation agents, floation cells.
1. Filtration : Theory, operation, types, flotation agents, flotation cells.
2. Filter calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration-Constant pressure and constant rate and their equipment. (8)

Unit V :
1. Centrifuges : Theory, equipments, types and calculations.
2. Cyclones : Hydrocyclones, liquid scrubbers and electronic precipitators. (7)

Unit VI :
1. Adsorption, theory, type and application, Langmuir's Freund Lich's equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidized beds.
3. Recent developments in mechanical operations. (8)

Text Books :

1. Bedger and Bencharo, "Introduction to Chemical Engineering". Tata McGrow Hill.
2. Narayanan C.M. & Bhattacharya B.C. "Mechanical operations for chemical engineers", Khanna Publishers. 3rd Ed. 1999.

Reference Books :

1. Coulson and Richardson : Chemical Engineering Vol.2.
2. Brown, G.G. and Associates "Unit operations" Wiley, New York.

4 PP 02 POLYMER CHEMISTRY

SECTION-A

Unit I : STEP POLYMERISATION : Chemistry and Mechanisr polycondensation reaction, functional groups, kinetic polycondensation reaction reactivity of equivaluer step polymerization, some important step polymer, such poicarbonate, Aromaric-sulphones, Aromatic Polyamides Aromatic Polyethers, Aromatic Sulfides.

Unit II : RADICAL CHAIN POLYMERISATION : Introduction to radical chain Polymerisatin, Comparison of radical and step polymerisation. Chemistry and mechanism of radical chain polymerisation.

INITIATION: Thermal decomposition of initiator, Kinetics of intiation.

RADIX INITIATION: Type of radix initiations, Photochemical initiations bybulk monomer, irradiation of thermal and radix initiation.

INITIATOR EFFICIENCY: Mechanism ofLoweringor initiator efficiency experimental determination ofinitiator efficiency.

Unit III : IONIC Cf-WN POLYMERISATION

CATIONIC CHAIN POLYMERISATION: Comparison of ionic chain polymer withradical chain polymer, Initiations by Protonic acids Lewis acids Propagation. Term ination by transfers, combination with counter ions and backbitting. Inhibitors and Retarders.

ANIONIC CHAIN POLYMERISATION : Comparison of cationic with anionic chain polymerisation. Initiation by nucleophilic initiators, Electron transfer, Various modes of termination such as termination by added transfer agents, hydride elimination and polar monomer .

SECTION-B

Unit IV : COPOLYMERISATION : Chemistry of block. graft, random and alternate copolymer Free-radical-copolyrnerisation. Monomer reactivity ratio and its determination. Co-relation between monomer reactivity ratio and copolymer structure. Factor affecting monomer reactivity. Alfray price equation.

Unit V : STEREO-CHEMISTRY OF POLYMERISATlO Introduction to isomerism, Tacticity stereo-chemistry of Polymeriaction of monosybstituted ethylenes disubstituted ethylenes, 1.3-btltadience properties of stereogular polymer. Mechamisum of sterespecific placement.

ZIEGLER-NATTA POLYMERIZATION: Componments of ziegler Natta Catalyst. Effect of the compoments on zigler Natta initiator system. Mechanisum of ziegler Natta polymerisation. Metallocene catalysts for polyoleffins, its mechanism.

Unit VI : Chemistry ofThermoseting Polymers .. Chemistry of synthetic and crossl inking thermosetts, such as phenolics, aminoresins, epoxides, unsaturuted polyurathens.

BOOKS RECOMMENDED :

1. Principles of Polymerisation : C.C. Odin.
2. Structure and Mechanism in Vinyl Polymerisation : Marcell Decker.
3. Kinetics and Mechanism of Polymerisation Reaction PEM Allen & C.R. Patrick.
4. Text Book of Polymer : Cliendslvy Vilmeyer
5. Copolymerisation : G.C. Man Marcel Decker.
6. Principals of Polymer Chemistry - P.G. Flory.
7. Polymer Chemistry : Bruno vollmart
8. Polymer Science & Tech. of Plastics & Rubber : P. Ghosh.
9. Physical Chemistry of Polymer - Tager.
10. Polymer Science : V. Gowarikar.

4 PP03/ 4 CH02 / 4 CT03 MACHINE DESIGN & DRAWING

Unit I :

1. **Mechanical Engineering Design :** Traditional design methods, Design process, Design synthesis, Standardisation Limits, Fits and tolerances.
2. **Engineering Materials**: Mechanical Properties of materials I.S.designation of materials, selection of materials.

Unit II :

1. **Design for static and fluctuating loads:** Brittle and due title/Theories of failures, Factor of safety, stress concentration, Fluctuating Stresses, Endurance Limit, Solderberg diagrams, notch sensitivity/Materials.
2. **Shafts & Bearings:** Transmission shafting. ASME Code, Design on the basis of rigidity, Design of keys and couplings. Types of rolling contact bearing. Static and dynamic load carrying capacity, election of rolling contact bearing from manufacturers catalogue.

SECTION-B

Unit III : Bolted, Riveted and Welded joints : Type of rivctted joints, stresses in rivets, Thin cylinders with riveted joints, Types of welded joints, welded and riveted joints subjected to accentric loading. Belted joints.

Unit IV : Belt, Chain and Gear Drivers : Types of belts and Chains, selection of belts and chains from manufactures catalogues.

Uniit V: Types of gears, Gear tooth profiles, Gear train velocity ratios, Gear tooth load for spur, helical level and worm gears, Design of spur gears.

Unit VI : Cylinders and pressure vessels; Thick and thin cylinders, Design of pipe lines and hydraulic vavles. Introduction to design of unfired pressure vessels.

Books Recommended :

1. Mechanical Engineering Design by J.E.Shigley, Mc Graw hill.
2. Design of Machine Elements, by M.F.Spotts, Prentice Hall.

4PP04 MATERIAL SCIENCE & TECHNOLOGY

UNIT I : **NATURE OF MATERIALS:** Micro and macro structures, properties and definitions; mechanical, thermal, chemical, electrical and magnetic properties, processing of metals and alloys - casting - hot and cold rolling - extrusion - forging - deep drawing - plastic deformation of metal, single crystals and polycrystalline metals - recovery and recrystallization of plastically deformed metals. (7)

UNIT II : **FERROUS METALS:** Pure iron; cast iron; mild steel, stainless steels, special steels and alloys; high temperature steels; iron - iron carbide phase diagram; heat treatment of plain - carbon steels. Manufacture, properties and application in chemical industries. (8)

UNIT III : **NON-FERROUS METALS:** Lead, tin and magnesium; manufacturing methods, properties and application in process industries.

NON METALS:

i. POLYMERIC MATERIALS: Polymerization reactions - Industrial polymerization methods - Crystallinity and stereo-isomerism in same thermoplastics - thermosetting elastomers - creep and fracture of polymeric materials.

ii. COMPOSITE MATERIALS: Fiber - reinforced - plastic composite materials - manufacturing methods - concrete - asphalt and asphalt mixtures - wood - sandwich structures.

iii. CERAMIC MATERIALS: Ceramic crystal and silicate structures processing of ceramics - properties-glasses - enamels. (16)

UNIT IV : **INORGANIC MATERIALS:** Manufacture of cement and its properties; special cement; cement concrete; reinforced and prestressed concrete: their properties and applications; mixing and curing. (3)

UNITS V : **CORROSION:** Definition and scope; basic theories and mechanism of corrosion; types of corrosion; application of corrosion; theories in equipment design and fabrication - anti-corrosion methods. (6)

UNIT VI : **COATINGS:** Organic paints and coatings; metal coatings; ceramic coatings; lining.

SELECTION OF MATERIALS: General criteria for selection of materials of construction in process industries. (5)

Books recommended:

1. Material Science and Processes, by S.K. Hajra Chaudhary.
2. Nature and properties of Engineering Materials by D. Jastrebski.
3. Material Science for Engineers, by Van Valack.

4 PP 05 MOMENTUM TRANSFER OPERATIONS

Unit I : Introductory Concepts about Fluids, Fluid statics and Fluii Kinemarics: Units arid Jimeris/ohs; dimensional analvsis. Fluids and Non Fluids, Nature of Fluid. Compressible and incompressible. Newtonian/Non Newtonian fluid, Viscosity of fluid. Newton's law of Viscosity.

Fluid Statics: Pascal Law, Hydrostatic equilibrium for compessible and incompressible fluid. U tube manometer, inclined manometer, differential manometer, inverted U manometer.

Fluid Kinematics : Types of fluid flow, potential flow fully developed flow, Steady and Unsteady flow, Uniform and noi uniform flow, Laminar and turbulent flow, Reynolds number and Reynolds experiement. Description of velocity field for laminar flow through cylindrical tube between two parallel plates. Vortex flow, free vortex and forced vortex .

Unit II: Continuity equation for fluid flow (in differential form for three dimension and integral form for one dimension)

Bernoulii's equation for potential flow, Kinetic energy. correction fluid friction iA pipe flow, concepts of friction factor. Relationship between friction factor and Reynolds No., pressure drop (Head loss due to friction). f Vs. NRC chart, Head loss due to sudden enlargement, sudden contraction, frictional losses due to fittings and valves, Power requirement for flow.

Unit III : Measurement of fluid flow:- Orificement, venturimeter Rotameter, Pitot tube, Notches and Weirs. Hot wire Anemometer quantity meter.

SECTION-B

Unit IV : Transportation of fluids : Description of pipe, tubings and valves and fittings. Pumping Devices for Liquids :

a) Centrifugal pump : Working principle, construction, Head developed by pump, Cavitation,N.P.S.H., priming, Performance and Characteristics curves, multistage pumps.

b) Positive Displacement Pump: Construction and working principle of-

I) Reciprocating Type: Piston, plunger and diaphram pump.

2) Rotary Type : Gear Pump, monopump, venetype and combination pump.

Unit V: Motion of particles through fluids, Mechanics of particle motion and equation for one dimensional motion of particle through fluid, terminal setting velocity, drag coeff, Stoke's law, Cd Vs. NRC, packed bed, loading and flooding point, fluidished bed and its types.

Unit VI : Hydraulic Fluid Power: Principle of power hydraullss, hydraulic fluids, hydraulic piping, tubing, sealing.

Hydraulic valves: Relief valves, R-type, Servo valves.

Hydraulic Systems:

1) Function and application of: Hydraulic accumulator, differential hydraulic accumulator, differential hydraulic accumulator, intensifer, ram, lift, riveter, gane.

Hydraulic Circuits: Symbols employed in various circuits. hydraulic circuits used in plastic processing machineries.

LIST OF BOOKS :

1) Chemical Engineering. Vol.1, By J.M. Coulson and J.F.Richardson.
2) Momentum Transfer Operation by S.K. Gupta.
3) Unit Operations of Chemical Engineering W.L. McCabe & J.C. Smith.
4) Fluid Mechanics by - Rao
5) Fluid Mechanics by - R.K. Bansal
6) Fluid Mechanics by - Modi & Seth.
7) Plastics Molding Plants Vol.-I.
(Hydraulics, Compression and Transfer Equipments) By - M.G. Munns, Published.
8) Unit Operation I (Mech. Operation) by Gavane.
9) Unit Operation II (Mass Transfer) by Gavane.

4PP06 CHEMICAL ENGINEERING OPERATION-I
(Mechanical Operation) –LAB

1. To study the performance of Ball Mill and find out it's crushing efficiency.
2. To study the performance of Jaw Crusher and find out it's crushing efficiency.
3. To study the performance of Crushing Rolls and find out it's crushing efficiency.
4. To study the settling characteristics (Free & Hindered settling) of a given suspension of particles.
5. To study the filtration characteristics of rotary vacuum filter.
6. To study the filtration characteristics of Plate and frame filter press.
7. To study the filtration characteristics of Leaf and sparkle filter.
8. To carry out differential and cumulative screen analysis of given sample of solid particles.
9. To determine energy consumption and crushing law constants for jaw crusher.
10. To determine Critical speed of Ball mill & Average particle size of the product obtained in ball mill, **OR** Average particle size of product obtained in Bhrustone mill.
11. To determine area of batch thickener by conducting batch sedimentation test.
12. To determine efficiency of Cyclone separator.
13. To Determine Variation of size reduction in ball Mill by changing the residence time, size of grinding medium and material of grinding medium.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.(Mechanical Operation)

4 PP 07 POLYMER CHEMISTRY-LAB

8 to 10 Practicals based on 4 PP 02 POLYMER CHEMISTRY

4 PP08/ 4 CH07 / 4 CT07 MACHINE DESIGN & DRAWING

DRAWING WORKS:
Drawing based on the above syllabus. Atleast four sheets of imperical size are expected.

4 PP 09 MOMENTUM TRANSFER OPERATIONS

1. Reynold's experiment.
2. To verify Bernouli's (equation) theorem.
3. To study frictional characteristics of fully developed flow.
4. To study losses in fittings.
5. To determine coefficient of discharge of venturimeter.
6. To determine coefficient of discharge of orificemeter, Flow of fluid through notches.
7. To compare the coefficient of drag (Cd) and Reynolds number of sphere.
9. To study sedimentation and to determine area of thickner from Batch Test.
10. Determination of viscosity of hydraulic fluid.
11. To study Characteristics Curves of centrifugal and reciprocating pump.
12. Study of various Hydraulic circukts.
    Any other experiment based on the above syllabut.

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS PRESCRIBED FOR
FOUR YEAR DEGREE COURSE IN
BACHELOR OF TECHNOLOGY
(CHEMICAL TECHNOLOGY)
FOOD, PULP & PAPER, OIL & PAINT AND
PETRO CHEMICAL TECHNOLOGY
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)
THIRD & FOURTH SEMESTER

SEMSTER : THRID

3 CT 01 APPLIED ORGANIC CHEMISTRY

SECTION-A

Unit I : 1) Aromatic hydrocarbons : Preparation, properties and applications of Benzene, Naphthalene and Anthralene

2) Heterocyclic compounds : Classification of heterocyclic compounds, preparation, properties and applications of pyrrole, thiophene, furan, pyridine, & quinoline.

Unit II : 1) Alcohols : Basic concepts, classification of alcohols, preparation, properties and applications of Lauryl & Cetyl alcohol.

2) Phenols : Basic concepts, classification, preparation, properties and applications of phenol, resorcinols, cresols, catechol and pyrogallol.

Unit III : 1) Acids and Esters : Basic concepts, preparation, properties and applications of Aceto acetic acid, malonic acid and their esters.

2) Amines and their derivatives : Basic concepts, classification of amines, preparation, properties and applications of aniline and Benzene diazonium chloride.

SECTION-B

Unit IV : 1) Study of Chemistry of Unit Process : Nitration, nitrating agents, kinetics and mechanism of aromatic nitration. Technical preparation of nitrobenzene and nitronaphthalene.

2) Study of Chemistry of Unit Process : Sulphonation and Sulphation : Sulphonating & Sulphating agents, kinetics

of mechanism of sulphonation. Technical preparation of Sulphonation of Benzene and sulphation of alpha lauryl alcohol.

Unit V : 1) Study of Chemistry of Unit Process : Halogenation : Halogenating agents, thermodynamics, kinetics. Technical preparation of DDT and Vinyl chlorides.

2) Principles of polymer chemistry and practices : Classification of polymerisation. Types of polymers. Technical preparation of Polyvinyl chloride, Bakelite.

Unit VI : 1) Carbohydrates : Basic concepts, classification, industrial applications of glucose, sucrose and starch.

2) a) Chemicals in food products : Study of preservatives, sweetening agents and antioxidants.

b) Chemistry of natural products : Classification of terpenes, alpha pinene, creramiol.

BOOKS RECOMMENDED :

1) Organic Chemistry (Vol. I & II) : I.L.Finar, Longman Group Ltd. and the English Language Book Society, London, 6th edition.
2) Advance Organic Chemistry : Fieser and Fieser, Asia Pub. House, Mumbai, 1961.
3) Unit Process in Organic Synthesis : P.H.Groggins, McGraw Hill, 5th edition.

3 CT 02 APPLIED PHYSICAL CHEMISTRY-II

Unit I : **Macromolecules :** Nomenclature, functionality and classification of macromolecules, Number average and weight average molecular weight of macromolecules , Methods of molecular weight determination , Viscosity measurement, Membrane osmometry, Light scattering , Sedimentation and ultracentrifuge methods, Intrinsically and Extrinsically conducting polymers, Doped conducting polymers and their applications, Effect of polymer structure on properties of polymers, Numerical on molecular weight determination. (6 Hrs)

Unit II : Electrochemistry :

Ion transport in electrolytes : Conductivity of strong and weak electrolytes, Specific, Equivalent and Molar conductivity, determination of conductivity, Effect of dilution on

conductivity, Kohlraush law and ionic mobility ,Electrolytic concentration cell

Electrical phenomenon at interface : Electrical double layer, electrode potential, Nernst equation, Debye- Huckel's theory of strong electrolyte , electrokinetic phenomenon.

Applications of electrochemistry : Determination of hydrogen ion concentration, determination of pH, Determination of dissociation constant, Determination of activity and activity coefficient from equilibrium constant

Electrometric titrations : Conductometric and potentiometric titrations, their applications. (10 Hrs)

Unit III : Thermodynamics

Origin of First law, thermodynamic terms and their definitions, Heat ,Energy and work function Second law, carnot's cycle, heat pump and refrigerator, thermodynamic temperature scale, concept of entropy, Entropy of spontaneous and reversible process, Helmholtz and Gibbs free energy, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partial molar properties, chemical potential,

Unit IV : Photo- chemistry, spectroscopy and advanced analysis Techniques

Photo- chemistry : Photochemical reactions, lamberts and Beers law, Law of photochemical equivalence, Quantum efficiency and its determination, Deviation from Stark- Einstein law, photosensitization

Spectroscopy : Introduction, Types of spectra & different spectral regions, derivation of moment of inertia , energy and wave number for rigid rotator, IR- Spectra, NMR- Spectra, instrumentation and their applications.

Thermal analysis techniques of polymers : Thermal Gravimetric Analysis (TGA) , Differential Thermal Analysis (DTA), and Differential Scanning calorimetric (DSC) (8 Hrs.)

Unit V : Kinetics and molecular reaction dynamics

Chemical equilibrium : introduction, law of mass action, equilibrium constants Kp, Kc & Kx, their interrelation .

Kinetics : Concept of reaction rate and extent of reaction , order and molecularity of reaction, rate law for first, second and third order reaction, Kinetics of polymerization reaction, Methods for determination of order of reactions. Theories of reaction rate,

Unit VI : Surface phenomenon and Catalysis

Adsorption , Classification of adsorption, Freundlich isotherm , Langmuir theory of adsorption, BET adsorption isotherm and its application for determination of surface area of fine powder. Numerical on isotherm and surface area.

Catalysis : Characteristics of catalyst, Homogeneous and Heterogeneous catalysis, mechanism of catalytic action, Enzyme catalyst, Concepts of acid- base catalysis, Contact theory of Heterogeneous catalysis (8 Hrs)

Books recommended :

1. Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill
6. Polymer chemistry, Gowarikar.

3CT03 /3CH03 / 3PP03 STRENGTH OF MATERIALS

SECTION-A

Unit-I :

1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,
2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II :

1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.
2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section.

Unit-III :

1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft.
2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV : Thin cylinders and spherical shells subjected to internal pressures.

Axially loaded columns (Euler's and Rankin's formula).

Unit –V :

1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI : Deflection of beams

Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

Books Recommended:

Text Books:

1. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .
2. Ramamruthm : Strength of Material, Danpat Rai and Sons, New Delhi.

Reference Books:

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 1990.
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material a Practical Approach, First Edition University Press, Hydrabad.

3 CT 04 APPLIED THERMODYNAMICS

SECTION-A

Unit I :

Text Books:

1. B.I.Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill, 3rd Edition, 2004
2. A.Hougen, K.M. Watson and K.A.Ragatz, "Chemical Process Principles", Vol 1, John Wiley

3 CT 06 APPLIED ORGANIC CHEMISTRY-LAB

1) Identification of pure organic compounds on the basis of reactions of the functional groups (any four compounds)
2) Separation of the two component simple mixture and their identification (any four mixtures)
3) Simple organic preparations :
   i) Acetanilide
   ii) Nitro Acetanilide
   iii) Aspirin
   (any two)

BOOK RECOMMENDED :

Laboratory Hand Book of Organic Qualitative Analysis and Separation : Kulkarni V.S., D. Ramchandra & Co., Pune.

3 CT 07 APPLIED PHYSICAL CHEMISTRY-II LAB

Measurement of molecular weight of polymers by viscosity measurement, Heat of neutralization and solution, Hydrolysis of methyl acetate, relative strength of two acids, rate constant with varying concentration of ester, order of reaction between (K2S2O8+ KI),Determination of equivalence conductivity of strong electrolytes at infinite dilution, conductometric and potentiometric titrations, Verification of Beer- Lamberts law, solubility of sparingly soluble salts by conductometric and potentiometric measurement, Specific rotation of cane sugar by polarimetry, determination of pH. Determination of refractive index. (Any 10 experiments)

3CT08 /3CH07 / 3PP08 STRENGTH OF MATERIALS-LAB.

Practicals :

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.

6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3CT09 APPLIED THERMODYNAMICS – LAB

Practicals :

Ten experiment based on the above syllabus evenly distributed, shall be performed and report/journal there of should be submitted by each student.

The practicals shall consist of practicals and viva-voce based on the syllabus and preactical work.

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SEMSTER : FOURTH

4 CT 01 ENGINEERING MATHEMATICS-II

Students are expected to be aware of the statements of the reievant tneorerns without mastering their proofs.

Unit I : Partial Differential Equations Basic concepts (@J 1.1), Vibrating string (@11.2), separationof variables (@11.3), one dimensionalheatf1ow(@11.5), Heatflow in an infinitebar {@11.6) (10 periods)

Unit II: Complex numbers and analytic functions
Complexnumbers(@12.1), polar fonn(@12.2),Complex function limit, derivative analytic function (@12.4), Cauchy Riemann Equat.ons, Laplace's Equation(@12.5), rational functions(@12.6), Exponential function (@12.7), Trigonometric and hyperbolic functions (@12.8), logarithm{@12.9)
(10 periods)

Unit III : Numerical Analysis
Errors in computation (@19.1), Solution of Equations by iteration, Newton - Raphson method (@19.2) Fmite differences {@19.3}, Interpolation (@19.4), Numerical integration using rectangular, trapezoidal and Simpson's rule, numerical differentiation (@19-6) (10 periods)

Unit IV : Optimization Basic concepts (@22.1), Linear programming{@22.2), Simplex method{@22.3),(@~2.4)
(l0 periods)

Unit V : Probability and Statistics
Sample mean and variance (@23.3), probability (@23.S), Permutations and combinations (@23.6), descrete and continuous distributions (@23.7), mean and variance of a distribution (@23.8), Binomial, Poisson distributions (@23.9), Normal distribution (@23.10) (10 periods)

Unit VI : Probability and Statistics (continued)
Random sampling (@23.12), Estimation of parameters (@23.13), confidence intervals (@23.14), Testing of hypothesis (@23.15), Fitting straight lines (regression analysis) (@23.20)
(10 periods)

Note : Numbers in bracket refer to section number; T1 "Advanced Engineering Maths" by Erwin Kreyszig (Finn jdn), Wiley Eastern.

Books Recommended :

1) Elements of Applied Mathematics: P.N. Wartikar & J.N. Wartikar
2) A text book of Applied Mathematics: P. N. Wart i ku r & J. N. Wartikar
3) Advanced Engg.Mathematics - Erwin Kreyszig, Wiley Eastern (5th Edition)
4) Higher Engg.Mathemetics . B.S.Greval.

4 FT 02 FOOD TECHNOLOGY-I

CHEMISTRY OF FOODS

Development of Food Chemistry :
History of Food Chemistry. Nature and Origin of life. Basic activities of animals and plants and their relations.

Water and Ice:
Importance of water in foods. Structure of water and ice. Concept of bound and free water and their implications.

Carbohydtrates :-
Nomenclature, Classification and structure of Carbohydrates. Chemical reactions of carbohydrates. Physical and Chemical properties of sugars, starch, pectic substances, gums and other polysacchrides, Functional properties of carbohydrates in foods.

Lipids:
Definition and classification of lipids, Chemistry of fatty acids and glycerides, Physical and chemical characteristics.
Chemistry of processing of fats and oils, hydrogenated fats, shortening agents and confectionery fat etc. Rancidity of fats and oils, its prevention and antioxidants. Functional properties of lipids in foods.

Protein:
Importance of proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides and proteins Sources and distribution of proteins. Isolation identification and purity of proteins, Denatruation Functional properties of proteins in food.

Fruits and Vegetables:
Plant Cells and tissues, their structure, functions and physiology, Chemical Composition of edible plant tissue. Texture of fruits and vegetables. Effects of cooking on texture and composition of fruits and vegetables.

Meat. Fish and Poultry :
Animal Proteins, Structure and chemical composition of muscles, Myoglobin and hemoglobin - Post - Mortem charges regor mortis. Methods of cooking and processing and their influence on texture. Physical and chemical changes during cooking Palatability characters; texture and tenderness. Structure

and composition of eggs. Cbemistry and functional properties of eggs.

Milk and Milk Products :

Composition of milk, Physical and chemical properties of milk protein and effects of processing on these. Chemistry of milk product like cheese, cream, butter, ghee etc.

Miscellaneous:

Sensory perception of tests and flavors. .Browing reactions, Nutritive and non-nutritive sweetners. Food dispersions and their implications on foods.

Books Recommended :

1. Food Chemistry by L.H. Meyer, Publishers, Van Nostrand Reinhold Co.New York, Latest Edition.
2. Principles of Food Science- Edited by Owen R. Fennema, Part I Food Chemistry, Publishers Marce Dekker, Inc. New York.
3. The Chemical Analysis of Foods and Food Products : Morries, B.Jacobs 3rd Edition, Publishers Van. Nostrand Company, INC. Princeton, New.
4. Introduction to the Biochemistry of Foods by J..B.S. Braverman, Publishers Elsevier Publishing Co. Amsterdam, Latest Edition.
5. The Spice Hand Book by J. W.Patty, Publishers Chemical Publishing Co. Inc.New York,. Latest Edition.
6. Food Theory andApplication by Paul, Pauline and Palmer, Helen H., Publishers, John Wiley and Sons. NewYork,. Latest Edition.

4 PT 02 PULP & PAPER TECHNOLOGY-I
CHEMISTRY OF WOOD AND PULP OF PAPER MATERIALS

Species, anatomy and physical properties of Wood:-

Classification of woods, plants used in pulp and paper, gross structure of trunk, structure elements of wood, fiber dimensions water conducting system, food conducting system, reactions of wood, bark and its structural elements, dec of wood, physical properties of wood.

Fiber morphology: Cell formation and growth, fiber structure, chemical composition of wood, non-wood fibers used in pulping bast, fruits, grass, leaf, animal, mineral and synthe: ic fibers.

Cellulose: Chemistry and location in the cell, isolation molecular constitution, microfibrils, crystalline and amorphoupus Pulp of Paper biogenesis of the cell wall, Polysacchrides, sorption, swelling and solution of cellulose, degradation reactions of pulp of paper.

HemicelluJoses : Structure and properties of hemicelluloses.

Lignin: Lignification in wood, biological and biochemical aspects of lignin information, structure and properties of lignin, separation of lignin from woody

tissues and Fiber laboratory separation, commercial separation, analysis of 'lignin and utilization of Lignin.

Books Recommended :

I. "The Chemistry of Cellulose" by Emil Hauser, John Wiley & Sons, New York.
2. "The Methods of Cellulose Chern. " by Charles Dorce, Chapman & Hall, L.
3. High Polymers Vol V (Part-I to V) edited by Emil Ott & Others, Interscience Publishers.
4. Publishing Processes by S.A.Rydholm, John Wiley & Sons, Inc.,New York.
S. Pulp & Paper : Chemistry & Chemical Technology by James P. Cascy.

4 OT 02 OIL & PAINT TECHNOLOGY-I
(CHEMISTRY OF OIL AND FATS)

Natural Fats : Their Sources, classification and composition Constituents of natural fats : Glycerides, Phospholipids, Fatty acids, non-glycerides constituents, toxic constituents and detoxication, Nutritional functions of Fats.

Glycerides and fatty acids : Nomenclature, Structure, occurence in fats.

Physical properties of fats and fatty acids. Elementary ideas on their liquid properties, solution properties and spectral properties.

Chemical reaction of fats and their fatty acids. Chemistry of hydrogenation, hydrogenolysis, autoxidation, polymerisation dehydration, pyrrlysis, halogenation, sulpation and sulphonation esterification, interesterification and hydrolysis and hydraziolysis, Chemical Oxidation of fatty acids, Significance and importance of these reactions.

Physical and Chemical characteristics : Elementary methods of oilseeds, oils, fats and fatty acids. Identification of fats. Detection of adulternation in fats and Indian standards for oils and fats. Oils Antioxidant and synergists.

Books Recommended :

1. Industrial Oil and Fat Products Ed. : A.E.Bailey. Interscience & Sons New York, London, Sydney 3rd Edition.
2. An Introduction of the Chemistry and Biochemistry of Fatty Acids : Gumstone.
3. Progress in the Chemistry of Fats and other liquids (Vols. 1 to 11) T.R.Holmann, Pergamon Press.
4. Fatty Acids : K.S.Markley, Inter Sc.Publishers, 2nd edition, New York.

5. Industrial Chemistry of Fats and Waxes : T.Hilditch Balliere Tindall and Cox, London 2nd Edition.
6. In-Hibiton of Fat Oxidation Processes :K.A. Allen
7. Rancidity of Edible Fats : C.H.Lea, His Majesty's Stationary Office, London, Latest Edition.
8. Analysis of Fats and Oils : V.V.Mellen Bacher, Garrard Press Publishers, Illinois, Latest Edition.
9. Technical Books of Oils and Fats Analysis : L.V.Cocks.

4 PC 02 PETROCHEMICAL TECHNOLOGY-I

CHEMISTRY OF PEIROLEUM HYDROCARBONS

Origin, occurence, exploration or" crude' petroleum (Oil). Geophysical methods used in prospecting. Drilling. Production transportation and storage of crude oil. Hydrocarbon resources in India, history and future trends.

Classification and description of crude oils.

Hydrocarbon composition of petroleum and petroleum products (liquid and gas). Nonhydrocarbon compounds in petroleum.
Use of modem physico-chemical techniques such as UV.I.R.NMR Mass spectroscopy, GLC etc. in petroleum and product analysis and hydrocarbon molecular structure determination of petroleum fractions.

Thermodynamics, reaction mechanism and kinetics of principle catalytic and non-catalytic chemical and group reactions of hydrocarbons such as cracking, Pro lysis, reforming, isomerization, alkylation, hydrogenation, oxidation halogenation, polymerization etc.
Sources of hydrocarbons other than crude oil, future automative fuel sources, new and future energy sources.

Books Recommended :

1. Chemical Technology of Petroleum by Gruse and Stevens, Mc Graw Hill. Latest Edition.
2. Hydrocarbons from Petroleum by Rossini and Mair, Reinhold, Latest Edition. J
3. Modern Petroleum Technology by G..D. Hobson and W.Pohl. Applied Sciences Publishers, Latest Edition.
4. The Petroleum Chemicals industry by Goldstein and Waddams, E.& F. N. Spon Ltd. Latest Edition.
5. The Chemistry of Petroleum Hydrocarbons, Vols. I.Il & III edited by Brooks. Board, Kruiz and Schmerling, Reinhold Latest Edition.
6. Chemicals from Petroleum by Waddams, John Murry, London, Latest Edition.

7. An Introduction to Industrial Organic Chemistry by P. Wesiman, Applied Science, Latest Edition.

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4 CT03 /4 CH02 / 4 PP03 MACHINE DESIGN & DRAWING

SECTION-A

Unit I :
1. **Mechanical Engineering Design :** Traditional design methods, Design process, Design synthesis, Standardisation Limits, Fits and tolerances.
2. **Engineering Materials**: Mechanical Properties of materials I.S.designation of materials, selection of materials.

Unit II :
1. **Design for static and fluctuating loads:** Brittle and due title/Theories of failures, Factor of safety, stress concentration, Fluctuating Stresses, Endurance Limit, Solderberg diagrams, notch sensitivity/Materials.
2. **Shafts & Bearings:** Transmission shafting. ASME Code, Design on the basis of rigidity, Design of keys and couplings. Types of rolling contact bearing. Static and dynamic load carrying capacity, election of rolling contact bearing from manufacturers catalogue.

SECTION-B

Unit III : Bolted, Riveted and Welded joints : Type of rivctted joints, stresses in rivets, Thin cylinders with riveted joints, Types of welded joints, welded and riveted joints subjected to accentric loading. Belted joints.

Unit IV : Belt, Chain and Gear Drivers : Types of belts and Chains, selection of belts and chains from manufactures catalogues.

Uniit V: Types of gears, Gear tooth profiles, Gear train velocity ratios, Gear tooth load for spur, helical level and worm gears, Design of spur gears.

Unit VI : Cylinders and pressure vessels; Thick and thin cylinders, Design of pipe lines and hydraulic vavles. Introduction to design of unfired pressure vessels.

Books Recommended :

1. Mechanical Engineering Design by J.E.Shigley, Mc Graw hill.
2. Design of Machine Elements, by M.F.Spotts, Prentice Hall.

4 CT 04 MATERIAL TECHNOLOGY

SECTION-A

Unit I : Crystalline and non crystalline structure sensitive and insensitive properties and defects in crystals. Corelation of mechanical properties with reference to structure.

Unit II: Effect of temperature on mechanical properties various rnetho of improving the strength failure under service conditions

Unit III : Solid solutions phase diagrams and their relation to meta properties with reference to steels and cast irons.

SECTION-B

Unit IV : Heat treatment of steels and common on ferrous alloyes.

Unit V: Elastomers and plasiomers, molecular structure and properties of polymers, ceramic materials and retractories, High ternperature oxide ceramics glasses and their properties, composite materials.

Unit VI : Corrosion: Electrode potentials e.m.f and galavanic series, polarization forms of corrosion, rate factors, inhibition, prevention, control and testing, Corrosion behaviour of metals and alloys chemical resistance of polymers, Forming processes and corrosion. Non destructive methods of testing, Metallic, Plastic and other protective coatings.

Books Recommended :

1. Nature and properties of Engineering Materials by D.Jastrebski.
2. Introduction to Materials science by Guy.
3. Materia! Science and Processes by SK.Hajra Chaudhry
4. Material Science for Engineers by Van Valack.

4 CT 05/ 4CH01 FLUID FLOW OPERATIONS

The subject gives the knowledge of fluid flow and various fluid transportations. This knowledge is useful in different subjects to be studied in Chemical Engineering course.

Objectives: After studying the subject student will be able,

1. To distinguish between different types of fluids.
2. To understand the concept of viscosity.
3. To Calculate flow rates.
4. To understand the principles behind different flow meters.

5. To understand the principle and working of different fluid flow machinery.

SECTION A

Unit I: Properties of fluids and their classification.

Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids. Forces on submerged bodies. Rigid body motion, pressure measurements, Euler's equation. (8)

Unit II: Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis; Buckingham'sÐ.theorem ; Dimensionless numbers and their physical significance; Similitude criteria. Mixing and agitation of fluid, Types of mixers and their selection; Power requirement. (7)

Unit III: Fluid flow: Laminar and turbulent flows; Pressure drop in pipes and tubes, pipe fittings and pipe network and friction factor; Conservation of mass, momentum and energy; Navier-Stokes equation; Mechanical energy balance and Bernoulli's Theorem. (8)

SECTION B

Unit IV: Flow measuring devices for chemical plants: Orifice meter, nozzle and venturi meters, rotameter and pitot tube. (8)

Unit V: Pumping and compressing of chemicals and gases, reciprocating pumps, rotary pumps, centrifugal pumps and blowers. NPSH and calibration.

Mixing and agitation of fluids. Compressible fluid flow and aerodynamics. (8)

Unit VI: Flow past immersed bodies, flow through packed bed fluidized bed.

Introductory concepts of two-phase flow. (6)

Books Recommended:

1. McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill.
2. Chemical Engineering, Vol. 1, Coulson J. M. and Richardson J. F. Butterworth Heinemann, Oxford.

4 FT 06 FOOD TECHNOLOGY-I -LAB

General methods of proximate analysis of food materials. Analysis of Oils and Fats, Chemical Analysis of carbohydrates and proteins, taniles vitamanies etc. colorimetric methods for starch. and qualitative detection of carbohydrates and proteins, taniles, vitamins etc. Colorimetric methods for starch, polyphenols, carotenes Xanthophylls etc. Paper chromatography and qualitative detection of carbohydrates, proteins and, tats oils, Colour. test for oil.

Qualitative and quantitative analysis of acided and antioxidates. Chemical Preservations like benzoic acid and sulfur dioxide, Non-Nutritive Sweetness and emulsifying agents.

Books Recommended :

1. The Chemical Analysis of Foods, Sixth Edition by David Perason, J.O.A. Churbcill, 104 Gloucester place London. 70
2. Manual of Analysis of Fruits and Vegetable Products: S.Ranganna, Ph.D. Central Food Technological.
   Research Institute, Mysore, Publisher, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Food Analysis by A.G. Woodman, 4th Edition, Publishers, Mc.Graw Hill Book Company, INC, New York and London, Latest Edition.
4. Modem Food Analysis by F.Leslie Hart A.N. and Hary John Stone Fishes. Ph.D. Publishers, Springer - Verlag. Berlin Heidelberg, New York, Latest Edition.
5. Food Analysis by RLees, Published by Leonard Hill Books, London.
6. Official Methods of Analysis of Association of Official Analytical Chemists, Pub.Associ. Office, Anal, Chemist, Washington D.C. Latest Edition.
7. Approved Methods of the American Association of Cereal Chemist, Vols. I & II, Latest Edition. Published by American Association of Cereal Chemist inc. Paul, Minnesota U.S.A.

4 PT 06 PULP & PAPER TECHNOLOGY-I- LAB

Determination of various components of wood such as moisture content. ash content, Water Solubility, alkali, solubility extractives, lignin Cellulose; hemicellulose, holocellulose pentosans etc. Microscopic observations of fibrous materials.

4 OT 06 OIL AND PAINT TECHNOLOGY-I -LAB

Determination of various Physical and Chemical characteristics of oils, fats and waxes, colour, solubility and thermal test for purity. Analysis of oil

seeds and cakes, estimation of rancidity. Analysis of nickel catalysts and acid oils determination, Physical and Chemical, characrcrisitcs of vanaspatis, margarine and ghee. Detection of adulternarion.

Use of microscope, colonmeter, spectrophotometer, pI-I meter, untometer, polarimeter, viscometer, penetrometer and dialatometer.

4 PC 06 PETROCHEMICAL TECHNOLOGY-I -LAB

Analysis and testing of Petroleum and petroleum products Determination of acidity saponification Value, iodine value, Bromine Number, Smoke point, Aniline point and Diesel index, Cloud and Purpoint Flash and Fire point by different apparatus (Abel, Penxky-Martens, Cleveland) Congealing, Melting and Proprnelting point of waxes, Drop point and Cone- Penetration of Greases, Softening point and cone penetration of Bitumens etc.

Books Recommended :

1. I.P.Standards for Petroleum and its products. Published by Applied Science Publishers Ltd., London, 33rd Edition. Latest Edition.
2. Methods of Testing for Petroleum and its products, IS/1448 Part-I to Part IV published by Indian Standards Institution, New Delhi, Latest Edition.
3. American Standards for Testing materials, Publishers by ASTM, New York, Latest Edition.
4. Criteria of quality of Petroleum Products - I.P., Allinson. Applied Science Publishers Ltd., London, Latest Edition.
5. Quality Assessment of Petroleum Products - Edited by George Sell, I.P.London, Latest Edition.

4 CT07 /4 CH07 / 4 PP08 MACHINE DESIGN & DRAWING-LAB

DRAWING WORKS:

Drawing based on the above syllabus. Atleast four sheets of imperical size are expected.

4 CT 08 MATERIAL TECHNOLOGY-LAB

Ten experiments based on the above syllabus evenly distribute shall be performed and a report/journal there of submitted by each student.

The practical Examination shall consist of practicals and viva voce based on the syllabus and practicals.

4 CT 09 /4 CH 06 FLUID FLOW OPERATIONS - LAB

List of Experiments:

1. To obtain the coefficient of discharge for the given venturimeter and obtain its relationship with Reynolds' no.
2. To calibrate the given Rotameter.
3. To obtain the coefficient of discharge for the given orifice meter and obtain its relationship with Reynolds' no.
4. To study the flow and determine critical Reynolds no.
5. To determine the discharge co-efficient of the given v-notch.
6. To verify the Bernoulli's theorem.
7. To determine the viscosity of the given liquids using Stoke's law.
8. To determine the viscosity of a given liquid by measuring efflux time of a given tank. Also determine the diameter of a given capillary and compare.
9. To determine relation between friction factor and Reynolds number for the given flowing fluid through circular pipe.
10. To obtain relation between friction factor and Reynolds number for flow of water through annulus.
11. To determine the resistance offered by various pipe fittings and express them in terms of equipment straight pipe length.
12. To study characteristics curves for a centrifugal pump.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

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Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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SYLLABUS
PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
B.E. BIOMEDICAL ENGINEERING
III & IV SEMESTER EXAMINATIONS
SEMESTER PATTERN
(CREDIT GRADE SYSTEM)
THIRD SEMESTER

Inpalnt Training & Industrial Visit in the faculty of Engineering & Technology

1) a) the inplant training shall not be compulsory,

b) the inplant training shall be taken by students strickly during Summer vacation. after IVth or VIth Semester examination and / or during Winter vacation after Vth or VIIth Semester examinations,

c) the inplant training shall not be part of examination system, however, student shall prepare and submit report after completion of training to the concerned Head of Department alongwith certificate issued by the industry,

d) the inplant training shall be of minimum two weeks duration,

e) there shall not be any liability whatsoever on the Institution with respect to implant training of the students,

f) students shall undertake inplant training on their own risk and cost. An undertaking in this regards signed by student and parents shall be submitted before proceding for training to the concerned Head of Department/ Head of Institution.

g) the students shall complete inplant training under the supervision of concerned person in the industry,

h) Institutes shall help students to organise inplant training by way of correspondance,

2) Industrial Visit : Industrial visit may be organised for the students. Students should prepare & submit the report on Industrial visit to the concerned Head of Department/Head of Institution.

3BM01 TRANSFORMS & PROBABILITY

Unit I: Fourier Series: Introduction: Euler's formula; Problems on general Fourier Series; Conditions for Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even and Odd functions; Change of interval; Half range series; Typical Waveforms (Square, Sawtoothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity

Unit II: Fourier Transform (FT) and its properties; Inverse Fourier Transform; Fourier transform of derivative; Convolution; Application of Fourier Transform in solving partial differential equations - Laplace's Equation (2D only), Heat Conduction Equation (I D only) and Wave Equation (I D only).

Unit III : Calculus of Complex Variable: Functions; Limits and Continuity; Analytic Functions; Cauchy Riemann Conditions; Analytic Continuation; Complex Integration and Cauchy's Theorem; Cauchy's Integral Formula; Taylor's and Laurent Series; Zeros of an Analytic Function; Poles; Essential Singularities; Residue Theorem (statement only) and it's application to evaluation of integral; Introduction to Conformal Mapping; Simple problems.

Unit IV : Probability and Statistics:

Mean, Median, Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; . General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability

Unit V : Distributions - Probability mass function; Probability density function; Distribution Function; Expectation; Variance; Probability Distribution-Binomial, Poisson and Normal. Correlation and Regression; Method of Least Squares; Linear Curve Fitting.

Unit VI : Graph Theory:

Graphs; Digraphs; Isomorphism; Walk; Path; Circuit; Shortest Path, Tree; Properties of Tree; Binary Tree; Fundamental Circuit; Minimal Spanning Tree: Kruskal's Algorithm; Prim's Algorithm. Cut Set; Fundamental Cut Set and Cut Vertices; Matrix Representation of Graphs . Network; Flow Augmenting Path; Ford-Fulkerson Algorithm for Maximum Flow; Max Flow - Min Cut Theorem

Text Books:

I. Grewal B S: Higher Engineering Mathematics (thirtyfifth edn) - Khanna Pub.
2. Lakshminarayan- Engineering Math 1.2.3
3. Prasad: Partial Differential Equations, New Age International
4. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill
5. Ross S L: Differential Equations - John Willey & Sons.
6. Bhat: Modern Probability Theory, New Age International
7. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.

3BM02 **HUMAN PHYSIOLOGY**

Unit I : Basic Biological (Biophysical & Biochemical) Principles:

Diffusion, surface tension and viscosity - their characteristics, factors influencing and biological applications. Osmosis - osmometers,laws of osmosis, biological applications, relation with depression of freezing points. Acids, bases and pH. Colloids - classification,properties - optical and electrokinetic, biological importance of colloids. Dialysis and ultra-filtration. Electrophoresis: Principles & applications, Gel electrophoresis. Adsorption. Gibbs-Donnan equilibrium. Radioactivity - radioisotopes and their biological applications. Principles of radioimmunoassay (RIA), autoradiography. The resting membrane potential. The action potential. Electrotonic potentials. Propagation of nerve impulse in different types of nerve fibers. Compound action potentials.

Unit II : Genetics:

Nucleic acid- I. Structure of DNA- Physical & Chemical properties of DNA & RNA, Ultra structure & types of DNA & RNA(indetails), Brief idea about super coiling of DNA Semiconservative mode of replication of DNA, Mechanism of replication of DNA"Genetic code. Genetically relation of color blindness and ocular albinism.Chromosome

aberration- Structural aberration- Deletion- Duplication- Inversion- translocation. Numerical aberration (Polyploidy - &aneuploidy- Hyper & hypo). Gene mutation- classification- spontaneous & Induced- Chemical mutation- Practical Application of mutation.

Unit III : Blood Vascular system

Composition and functions of blood. Plasma proteins - normal values, origin and functions. Brief idea on Bone marrow. Formed elements of blood - origin, formation, functions and fate. Hemoglobin - functions, compounds and derivatives. Abnormalhemoglobin-overview. Thalassemia-brief idea. Different types of anemia and their causes-overview. Erythrocyte sedimentation rate(ESR) and its significance. Hematocrit. PCV, MCV, MCH~ MCHC. Blood volume -normal values, regulation. Blood coagulation -factors, process, anticoagulants, Prothrombin time. Clotting time. Bleeding time. Blood groups - ABO systems and Rh factors. Bloodtransfusion.UItra structure & functions of blood vessels (artery & vein). Structure type and function of capillaries. Differences between artery &vein.

Unit IV : Muscular Physiology:

Microscopic and electron microscopic structure of skeletal, smooth and cardiac muscles. Difference between skeletal, smooth andcardiac muscles. The sarcotubular system. Red and white striated muscle fibers. Single unit and multi unit smooth muscle. Motorpoint. Properties of muscle: excitability and contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity. Electromyography. Muscle contraction - E C Coupling, Muscle fatigue, Rigor mortis, Sliding filament theory, Slow & fast musclefibers, Isotonic & Isometric contraction.

Unit V : Neuro Physiology:

Electron microscopic structure of nerve cell or neurons. Neuroglia. Myelinated and unmyelinated nerve fibers. Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibers. Synapses - types, structure, synaptic transmission of the impulse, synaptic potentials, neurotransmitters. Motor unit. Injury to peripheral nerves- degeneration and regeneration-brief idea. Automatic nervous system - Introduction, Comparison of autonomic & somatic nervous system, Anatomy of autonomic motor pathways - Pre-ganglionic neurons, autonomic ganglia, sympathetic ganglia, autonomic plexus, post-ganglionic neurons structure of sympathetic and parasympathetic division. ANS- neurotransmitter and receptors- cholinergic neurons & receptors. Receptor agonist & antagonist. Physiological effect of ANS- sympathetic & parasympathetic response. Integration & control of autonomic function- autonomic Reflexes, autonomic control by higher centers.Neural Transmission- Introduction, Autonomic Synaptic Transmission-Modes of transmission, sympathetic & parasympathetic response. CNS Synaptic transmission- Electrical synaptic transmission & chemical synaptic transmission.Neuro muscular Junction - The neuromuscular junctions - structure, events in transmission, end-plate potential, post titanic potential.

Unit VI : Cardio Vascular System

Structure & function of Heart & blood vessels (m1ery, vein and capillary) (Anatomical position, chambers of heart.) Blood circulationthrough heart. Special Cardiac cycle. Heart Sound , Blood vessels - type, Structure & function, Systemic & pulmonary circulation. Blood - composition, Function, blood group, Blood clotting. Cardiac cycle and cardiac output. Blood Pressure-regulation & controlling factors.

. Renal System- Function of kidney, Anatomy & Histology of Nephron & collecting duet. - Urine formation (Filtration, reabsorbtion and secretion)- Counter - current system of urine concentration, Anomalies in urine concentration. Physiology Practical Code: BME 392

Text books

1. Snell, Bio Physical Principles of Structure and functions
2. Ruch and Patton, Bio Physics and Medical Physiology

Reference books

1. Concise medical physiology by Sujit K. Chaudari , New central book Agenc Pvt. Ltd.
2. Textbook of Physiology by Chattergi

3BM03 TRANSDUCER AND SIGNAL CONDITIONING

SECTION A

UNIT I: Transducer : Defination, Classification, Selection criteria.Errors Loading effects, Basic configuration of control system Transducer specifications. (07)

UNIT II: Displacement,Fore & Torque Transducers: Displacement Resistive, Inductive, Strain gauge, Capacitive, Piezo electric Digital, fibre optic, Laser type transducers.

Force-Force measuring transducers, Electric load cell,LVDT, Piezo electric type.

Torque Strain Gauge transducers. (08)

UNIT III: Temperature Transducers: Temperature scales,Glass thermometers,Bimettalic & memory shaped alloy thermometers, Semiconductor, temprature detector (thermistor & P-N junction). Resistance themometer, Themocouples,Ultrasonic, Crystal, Infrared thermometers

Velocity Transducers: Tachometers, Toothed rotor tachometers,photo electric, Stroboscopic principles. (09)

SECTION-B

UNIT IV : Flow Transducers: Basic measurement principles, Bernoulli’s theorem, Differential pressure type (Orifice, Ventury,Anubar Pitot tube),Variable area type, Magnetic, Ultrasonic,Positive displacement type ,Mass flow meter, Annemometer,Total flow meter.

Level Transducers:For liquids & solids - float type displacer, Diaphragm box level gauge ,DP cell Ultrasonic, Radioactive transducers,Microwave. (10)

UNIT V: Pressure Transducers: Pressure scales & standards, Manometers, Elastic(Bellows,Bourdon tube,Diaphragm)type, Electrical pressure sensors (LVDT,Strain gauge,load cell,Piezo-electric,Capacitive),Differential pressure sensors(Capacitive,Force balance & vibrating cylinder type),vacuum pressure measurement, thermal conductivity & ionization type, Transducers for very high pressure measurement. (09)

UNIT VI: Humidity Transducers:Psycrometer,Hygrometer(Hair,wire & Electolysis type),Dew point meter.Piezo-electric humidity meter,Infrared conductance & Capacitive type probes for moisture measurement.Acoustic Transducer & sound level measurement. pH & Conductivity sensors:pH scales & standards,principle of pH measurement,Different types of reference & measuring electrodes.Principles of conductivity measurement, conductivity cells & bridges. (09)

REFERENCE BOOKS :

1. Measurement System by E.O.Doebelin
2. Principles of Industrial Instrumentation by Patranbis
3. Experimental Methods for Engineers by J.P.Holman
4. Mechanical Industrial Measurements by R.K.Jain

3 BM04 ELECTRONIC DEVICES & CIRCUITS

SECTION-A

UNIT I: Diodes : Characteristics of semiconductor diodes,diode resistanse. Rectifying circuits & do power supplies,HWR,FWR,BR,comparison. Filter circuits for power supplies: Inductor, Capacitor, LC, IT Filters.

UNIT II : Concept of amplification,Ai,Av and Ap; Ri,Ro.Conversion efficiency. Basic transistor operation,Basic characteristics of transistor amplifier. Transistor input characteristics,CB amplifier CC amplifier.

UNIT III: The CE amplifier Graphical analysis, Input & output resistance, Input wave form consideration, Comparison of amplifiers. Transistor biasing : Stability Factor, CB bias , Emitter bias, Bias compensation.

SECTION-B

UNIT IV : Oscillatars : Effect of positive feedback. phase-shift oscillator, Wein-Bridge oscillator, RC Oscillator, Transistor as a switch, switching time in transistors, Multivibrators.

UNIT V : FET amplifiers: Advantages & disadvantages of FET. Principle of operation, characteristics, Comman source AC amplifier. Fixed Bias. Source follower, Frequency Response. Introduction is MOSFETS.

UNIT VI: Opto Electronic Devices : Fundamentals of light, photoconductive sensors, photodiodes, phototransistors, their principle of operation & applications.photovoltaic sensors.photoemiss ive sensors.Light emitters,Alphanumeric displays. photocouplers.

Text Books :

1. Malvino : Principles of Electronics (TMH)
2. Millmam & Halkias : Electronic Devices & Circuits (Mc Graw Hill)
3. Millmam & Halkias: Integrated Electronics (Mc Graw Hill)
4. David A Bell "Electronic Devices & Circuits" (5/e) (Oxford University Press).

3BM05 BIOPHYSICS

Unit I :- Body fluid: Properties of body fluid, determination of conduction of body fluid, measurement of EMF of cells, temperature and reaction rates: Arrhenius equation. Photochemical reaction, the law of photochemistry, fluorescence and phosphorescence, Principles of colorimeter, Beer-Lambert's law.

Unit II :- Biophysical activity of heart: electrical activity of the heart, junctional tissue of heart.(Myogenic and neurogenic heart-conducting system of heart). monophonic and biphasic recordings, original and propagation of excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiography, waveform and easurement, ECG in diagnosis, arrhythmia's, flutter, fibrillation, vulnerable period, phonocardiography, ballistocardiography.

Unit III :- Biophysical activity of brain and other organs: electrical activity of brain, waveforms & measurements, electrogastrography, electroneurography, nerve conduction studies, electroretinography, electroocculography, recording electrodes, interfaces,skin contact impedance, biological transducers, receptor potentials.

Unit IV :- Introduction to electrical simulation: Properties of nerve fibers - excitability, conductivity, all-ornonelaw, accommodation, adaptation, summation, refractory period, indefatiguability impedance & current distribution, dielectric properties of biological materials, skin impedance, total body impedance, impedances at high frequencies, high voltage & transient properties, patient safety, electrical shocks and hazards, leakage currents, types & measurements, protection against shock, burn & explosion hazards.

Unit V :- Radioactivity: Radio emission, radioisotopes, law of

radioactive decay, half life period, production of radio isotopes for medical use, electromagnetic radiation, interaction of radiation with matter, exponential attenuation, half value thickness, photo electric, Compton and pair production process and their significance in radiology, radiation units, detection and measurements of radiation

Unit VI :- Introduction of ultrasonic wave: Ultrasonic wave motion, wave characteristics, intensity, and ultrasound properties in body (velocity, attenuation, reflection, refraction and absorption). Use of ultrasound in biological field.lntroduction of magnetic field: Optical activity and magnetic rotation of substances, dipole moments, magnetic properties of substances. Useful and harmful effects of magnetic fields, radio waves, micro waves, ultra violet radiation and infrared radiation on human beings.

Text books

1. W.R.Hendee & E.R.Ritenour, Medical Physics.
2. Massey and Meredeth, Medical Physics.

Reference books

1. Plummer, Bio Chemistry - The Chemistry of Life, Mc Graw Hill.
2. Patrick Rcully, Electrical Simulation & Electropathology, Cambridge University press
3. Joseph Bronzino, Biomedical Instrumentation.
4. Khandpur R S, Handbook of Analytical Instrumentation, Tata Mc Graw Hill
5. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3rd eds), Mosbey Year-Book.

3BM06 HUMAN PHYSIOLOGY-LAB

8-10 Experiments based on 3 BM 02 Human Physiology.

3BM07 TRANSDUCER AND SIGNAL CONDITIONING - LAB

LIST OF EXPERIMENTS

1. Testing & calibration of T,J,K,R & S thermocouples
2. Callibration of pt-100.
3. a) Callibration of strain indicator
   b) Weight measurement by load cell.
4. Study of LVDT & irrs application in thickness measurement
5. Level measurement by capacitance probe.
6. Flow measurement by Differential pressure type transducers
7. Study of Bellows,Bourdon tubes & Diaphragms.
8. RPM measurements using photodetector technique.
9. Study of electrical pressure probes.

10. Study of pH meter,conductivity meter.
11. Humidity measurement by psycrometer.

Note : Students are expected to perform minimum eight experiments

3BM08 ELECTRONIC DEVICES AND CIRCUITS-LAB

8-10 Experiments based on 3 BM 04 Electronic Devices & Ckts.

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FOURTH SEMESTER

4BM01 OBJECT ORIENTED TECHNOLOGIES

SECTION-A

Unit I : Objects & Classes in C++ : Declaring & using classes, Constructors, Objects as functions arguments, Copy Constructor, Static class data. Arrays of objects, C++ String class.

Unit II : Operator overloading : Overloading unary & binary operators. Data conversion. Pitfalls of operator overloading. Pointers & arrays. Pointers & functions. new & delete operators. Pointers for objects.

Unit III : Inheritance in C++ : Derived class & base class, Derived class constructors, Function overloading, class hierarchies, Public and private inheritance, Multiple inheritance. Containership : classes within classes.

SECTION-B

Unit IV : Virtual functions concepts, Abstracts classes & pure virtual functions. Virtual base classes, Friend functions, Static functions, Assignment and copy initialization, the this pointer. Dynamic type information.

Unit V : Streams & Files in C++ : Stream classes, stream errors, disk file I/O with streams, File pointers, Error handling in file I/O. File I/O with members functions, overloading the extractions & insertion operators, Memory as a stream object, command-line arguments. Multifile programs.

Unit VI : Function Template, Class templates, Exception syntax, Multiple exceptions, exception with arguments. Introduction to the Standard Template Library. Algorithms, Sequential Containers, Iterates, Specialized iterates, Associative containers. Function objects.

Text-Books :

1. Robert Lafore Object-Oriented Programming in C++ (Galgotia)
2. Herbert Schildt C++ : Complete Reference (TMH)

References :

1. Bjarne Stroustrupe C++ Programming Language (Addison-Wesley)
2. Venugopal Mastering C++ (TMH)
3. Lipmann C++ Primer (Addison-Wesley)

4BM02 ANALOG AND DIGITAL ICS

SECTION-'A' (8 hrs/unit)

UNIT-I : Introduction to ICs: Monolithic IC technology,the planner process, fabrication, BJT, FETs, CMOs Technology, characteristic of IC components, LST, Operational amplifier, Block schematic internal circuits, Level shifting,Overload protection,study of IC 741 op-amp,Measurement of op-amp parameter.

UNIT-II: Liner and Non-Linear Application Op-amp:-Inverting and noninverting amplifiers, Voltage follower, integrator, differentiator differential amplifier, Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using opamps. Astable, bistable and monostable multivibrator using opamps.

UNIT-III: Other linear ICs:- Block schematic of regulator IC 723, and applications, SMPS, Block schematic of timer IC 555 and application as a timer, astable, monostable, bistable multivibrator and other applications.

SECTION-'B'

UNIT-IV: Basic Logic Circuits:

Logic gate charcteristics,NMOS invertor, propogation delay,NMOS logic gate,CMOS invertor,CMOS logic gates, BJT invertor, TTL NAND gate, TTL output stage. TTL logic families, ECL circuits,comparision of logic families.

UNIT-V: Combinational Digital Circuits: Standard gate assemblies, Binary address, Arithmetic functions, Digital comparator, Parity check generators, Decode-multiplexer, Data selector multiplexer, Encoder, ROM, 2-dimensional addressing of ROM, ROM applications, PROM.

UNIT-VI: Sequential Circuits and Systems:Bistable Latch, Flip-Flops clocked SR, J-K, T, D type shift Registers, F.F.Design of counters, Ripple and synchronous types, application of counters, Dynamic MOS shift registers,RAM Bipolar RAM cells.

BOOKS :

1. Millaman : Microelectronic : 2nd Ed.Mc Graw Hill.
2. David A Bell "Electronic Devices & Circuits" (5/e) (Oxford University Press).
3. Gayakwad : Op-Amp & Linear IC's, 2nd Ed.
4. Malvino & Leach : Digital Principles & Applications, 4th Ed. Mc Graw Hill.

4BM03 **NETWORK ANALYSIS**

SECTION-A

Unit I : a] Terminal Element Relationships: V-I relationship for Inductance and Capacitance- Constant Flux Linkage Theorem and Constant Charge Theorem- v-i relationship for Independent Voltage and Current Sources - v-i relationship for dependent voltage and current sources- Source Functions: unit impulse, unit step, unit ramp and inter relationship, sinusoidal input ,generalized exponential input.

b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, the super node, mesh analysis, the super mesh, nodal vs mesh analysis

Unit II : Network Theorems : Linearity and superposition, source transformations, Thevinin's theorem , Norton's theorem, Maximum power transfer theorem, Delta-wye transformations Reciprocity theorem, Milliaman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorems.

Unit III : Time Domain Analysis of Circuits: Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-Complete Solution for step/impulse/sinusoid voltage/current inputs-Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of d.c steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method-Determination of initial conditions.

SECTION-B

Unit IV : a] Review of Laplace Transforms: Laplace Transform-Transform Pairs-Gate Functions-Shifting Theorem-Solution of Differential Equations by Laplace Transforms-Initial and Final Value Theorems-Laplace Transforms of periodic signals-Inversion of transforms by partial fractions-Convolution Theorem and Convolution Integral. <u>*(Review to be done by students. No class hour will be spent for this review.)*</u>

b] Transformation of a Circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain - Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - Solution of transformed circuits including mutually coupled circuits-Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots,

Unit V : a] Sinusoidal Steady State analysis: Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasor, phasor relationships for R L C, impedance and admittance , sinusoidal steady state analysis with phasors.

b] Fourier Series: Fourier Series representation of non-sinusoidal periodic waveforms - Fourier Coefficients-Determination of Coefficients-Waveform Symmetry-Exponential Fourier Series-Discrete Amplitude and Phase Spectra-Steady State Solution of Circuits with non-sinusoidal periodic inputs by Fourier Series

Unit VI : Two Port Networks: two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters-inter relationships among parameter sets-Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Network Functions-Pole Zero plots and steady state response from pole-zero plots.

Books Recommended :-

1) Engineering Circuit Analysis, 6/e By Hayt & Kemmerly, TataMcgraw Hill, 2004
2) Network Analysis, By M.E. Van Valkenberg, PHI, 2005
3) Electrical Circuits – David Bell, Oxford University Press, 2008
4) Linear Circuit Analysis, 2/e – De Carlo and Lin, Oxford University Press, 2009
5) Network Analysis, P. Ramesh babu, SCITECH Publications, Chennai, 2009
6) Circuit and Network Analysis By Sudhakar Shyammohan, Tata Mc Graw Hill, 2005
7) Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, Oxford University Press, 2010.

4BM04 SOCIAL SCIENCES & ENGINEERING ECONOMICS

SECTION - A (8 hrs/unit)

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy.

Unit II : Indian Parliament : composition and powers.
President of India : Election and Powers.
Council of Ministers and Prime Minister

Unit III: Impact of Science and Technology on culture and Civilization. Human Society : Community Groups, Social Control : Meaning, Types and Agencies. Marriage and Family : Functions, Types and problems.

SECTION - B

Unit IV: Nature and scope of Economics : Special significance of Economics to Engineers.
Production : Factors of production, Laws of return, Various Economic systems, Forms of Business Organisation.

Unit V : Banking : Functions of Central and Commercial Banks.
Taxation : Principle of taxation, Direct and Indirect taxes.
Market : Forms, perfect and imperfect competition, pricing under perfect and imperfect competition, prices discrimination under monopoly.

Unit VI: Economics of Development : Meaning, Characterisitcs of under development, obstacles to Economic growth and vicious circle of poverty.
Economic Planning : meaning, objective and salient features of current five years plan of India.
Planning horizons, life structuring the alternatives.
Economics of comparision of different alternative projects.

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. Joshi G.N. : The Constitution of India, Macmillan India Ltd.
3. Mahajan : The Constitution of India, S.Chand, New Delhi.
4. Maclaver and Page : Principle of Sociology.
5. Davis K. : Human Society
6. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
7. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
8. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
9. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi

P.M.Sundharam
10. Dhingra I.C. : Indian Economy
11. E.Kuper : Economics of W.R.Development, McGraw Hill Co.,
12. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

4BM05 BIOMATERIALS & BIOMECHANICS

Unit I :- Introduction: Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials.Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking. Host tissue reaction with biometal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants.

Unit II :-: Introduction of polymers, Polymeric implant materials, Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Synthetic polymeric membranes and their biological applications.Ceramic implant materials: Definition ofbioceramics. Common types ofbioceramics: Aluminium oxides, Glass ceramics,
Composite implant materials: Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out).

Unit III :- Biocompatibility & toxicological screening of biomaterials: Definition of biocompatibility, blood compatibility and tissue Compatibility. Toxicity tests: acute and chronic toxicity studies, sensitization, carcinogenicity, mutagenicity and special tests.Sterilisation techniques: ETO, gamma radiation, autoclaving. Effects of sterilization on material properties. Testing of biomaterials/lmplants: In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In-vivo testing (animals): biological performance of implants. Ex-vivo testing: in vitro testing simulating the in vivo conditions.

Unit IV :- Hard tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models - anisotropy, Electrical properties of bone, fracture mechanism and crack propagation in bones, fracture fixators, repairing of bones, mechanical properties of collagen rich tissues, teeth and its properties.

Unit V :- Soft tissues: Structure and functions of cartilages, tendons, ligaments, soft tissue mechanics, mechanical testing of soft tissues standard sample preparation, cross-section measurement, clamping of the specimen, strain measurement, environmental control, time dependent properties of testing.

Biomechanics of joints: Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, mechanics of shoulder, mechanics of spinal column, mechanics of hip, mechanics of knee, mechanics of ankle.

Unit VI :- Locomotion: Human locomotion, gait analysis and goniometry, Ergonomics, F:oot Pressure measurements - Pedobarograph, Force platform, mechanics of foot. Total Hip Prosthesis: requirements, different types of components, Stress analysis & instrumentation, Knee Prosthesis.Cardiovascular mechanics: Heart valves, artificial heart valves, biological and mechanical valves development.Fluid mechanics: introduction, viscosity and capillary viscometer, laminar flow, turbulent flow.

Test books

1. J B Park, Biomaterials - Science and Engineering, Plenum Press,
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House,
3. Alexander R Mc Neill, Biomechanics, Chapman and Hall,

Reference books

1. Jonathan Black, Biological Performance of materials, Marcel Decker,
2. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers.
3. Eugene D. Goldbera, Biomedical Ploymers, Akio Nakajima.
4. Lawrence Stark & GyanAgarwal , Biomaterials
5. L. Hench & E. C. Ethridge, Biomaterials - An Interfacial approach.
6. A Z Tohen and C T Thomas, Manual of Mechanical Orthopaedics
7. D N Ghista and Roaf, Orthopaedic Mechanics, Academic Press
8. VC Mow and W C Hayes, Basic Orthopedic Biomechanics, Lippincott, Raven publishers.

4BM06 OBJECT ORIENTED TECHNOLOGIES-LAB

LIST OF PROGRAMS

The sample list of program is given below. This list can be used as guide line for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1 Write a C++ program to implement a stack with its constructor and two member functions PUSH and POP

2 Write a C++ program to find product of two same numbers from 0 to 9 stored in an object array of 10 objects and then free the memory space occupied by an object array

3 Write a C++ program to overload minus operator as an unary and binary operator

4 Write a C++ program using friend operator function to overload plus binary operator

5 Write a C++ program to calculate the circumference of an earth (subclass) after getting distance of it measured from sun from planet (super class)

6 Write a C++ program for an inventory that stores the name of an item, the number on hand, and its cost. Include an inserter and an extractor for this class

7 Write a C++ program that creates an output file, writes information to it, closes the file and open it again as an input file and read the information from the file

8 Write a C++ program that counts number of words in a file

9 Write a C++ program to create an abstract class area having an abstract function get Area which will find an area of derived classes rectangle and triangle

10 Write a C++ program to create a generic function that swaps the values of the two variables it is called with"

4BM07 ANALOG & DIGITAL IC'S - LAB

List of Experments:

1. INV-NON INV Amplifer using IC 741.
2. INTEGRATOR & DIFFERTIATOR using IC 741.
3. Voltage follower using IC 741.
4. Weinbridge oscillator using IC 741.
5. Astable Multivibrator using IC 741.
6. Astable Multivibrator using IC 555.
7. Voltage regulator using IC 723
8. Verification of MUX using IC 74151.
9. Study of various DEMUX chips & verification of DEMUX using IC 74155.
10. Verification of transistor inverter.
11. Verification of BCD to seven segment using IC 7447.
12. Verification of J-K FF by using IC 7476.
13. Verification of Comparator using IC 7485.
14. Verification of BCD to demical decoder using IC 7442.
15. Verification of decade counter.
16. Code converters using PLAs.

NOTE : Any six from Sr.No. 1 to 7 and six from Sr.No. 8 to 16.

4BM08 NETWORK ANALYSIS-LAB.

Any TEN experiments based on contents of 4 BM 03 NETWORK ANALYSIS

Content of the Compulsory Subject "Environmental Studies" are given on Page Nos. ES-1 to ES-4 i.e. at the end of this syllabus.

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ENVIRONMENTAL STUDIES

Total Marks : 100

PART-A

SHORT ANSWER PATTERN 25 Marks

1. **The Multidisciplinary nature of environmental studies**
   . Definition, scope and importance.
   . Need for public awareness.

(2 lecture hours)

2. **Social Issues and the Environment**
   . From Unsustainable to Sustainable development
   . Urban problems related to energy
   . Water conservation, rain water harvesting, watershed management
   . Resettlement and rehabilitation of people; its problems and concerns. Case studies.
   . Envionmental ethics : Issues and possible solutions.
   . Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
   . Wasteland reclamation.
   . Consumerism and waste products.
   . Environment Protection Act.
   . Air (Prevention and Control of Pollution) Act.
   . Water (Prevention and Control of Pollution) Act.
   . Wildlife Protection Act.
   . Forest Conservation Act.
   . Issues involved in enforcement of environmental lesislation.
   . Public awareness. (7 lecture hours)

3. **Human Population and the Environment**
   . Population growth, variation among nations.
   . Population explosion - Family Welfare Programme.
   . Environment and human health.
   . Human Rights.
   . Value Education.
   . HIV / AIDS.
   . Women and Child Welfare.
   . Role of Information Technology in Environment and human health.
   . Case Studies. (6 lecture hours)

PART-B

ESSAY TYPE WITH INBUILT CHOICE 50 Marks

4. Natural resources :

. **Renewable and non-renewable resources :**

. Natural resources and associated problems.

- Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
- Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
- Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

. Role of an individual in conservation of natural resources.

. Equitable use of resources for sustainable lifestyles.

(8 lecture hours)

5. Ecosystems

. Concept of an ecosystem.

. Structure and function of an ecosystem.

. Producers, consumers and decomposers.

. Energy flow in the ecosystem.

. Ecological succession.

. Food chains, food webs and ecological pyramids.

. Introduction, types, characteristic features, structure and function of the following ecosystem :-

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lecture hours)

6. Biodiversity and its conservation

. Introduction - Definition : genetic, species and ecosystem diversity.

. Biogeographical classification of India.

. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

. Biodiversity at global, National and local levels.

. India as a mega-diversity nation.

. Hot-spots of biodiversity.

. Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.

. Endangered and endemic species of India.

. Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (8 lecture hours)

7. Environmental Pollution

. Definition

. Causes, effects and control measures of :-

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards

. Solid Waste Management : Causes, effects and control measures of

. Role of an individual in prevention of pollution.

. Pollution case studies.

. Diaster management : floods, earthquake, cyclone and landslides.

(8 lecture hours)

PART-C

ESSAY ON FIELD WORK 25 Marks

8. Field work

. Visit to a local area to document environmental assets - river / forest / grass land / hill / mountain

. Visit to a local polluted site - Urban / Rural / Industrial / Agricultural

. Study of common plants, insects, birds.

. Study of simple ecosystems - pond, river, hill slopes, etc.

(5 lecture hours)

(**Notes :** i) Contents of the syllabys mentioned under paras 1 to 8 shall be for teaching for the examination based on Annual Pattern.

ii) Contents of the syllabys mentioned under paras 1 to 4 shall be for teaching to the Semester commencing first, and

iii) Contents of the syllabys mentioned under paras 5 to 8 shall be for teaching to the Semester commencing later.

LIST OF REFERENCES :-

1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.

2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email : mapin@icenet.net **(R)**

3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

4) Clark R.S., Marine Pollution, Clanderson Press Oxford **(TB)**

5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7) Down to Earth, Centre for Science and Environment **(R)**
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(R) Reference
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******

DIRECTION

No. 31/2011 Date : 10/06/2011

Subject : Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology

Whereas faculty of Engineering & Technology in its meeting held on 6th June, 2011 vide Item No. 39 accepted and recommended schemes of teaching & examinations of III to VIII/X as per Credit Grade System of various branches as per Credit Grade System in the faculty of Engineering & Technology for its implementation from the session 2011-2012 in phase wise manner,

AND

Whereas the schemes of teaching & examinations of VII & VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology were accepted by the Hon'ble Vice-Chancellor u/s Section 14 (7) of M.U. Act, 1994 on behalf on Academic Council on 9th June, 2011,

AND

Whereas this schemes of teaching & examinations of various branches as per Credit Grade System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of various branches as per Credit Grade System in the faculty of Engineering & Technology are to be implemented from the academic session 2011-2012,

AND

Whereas syllabi of various branches in the faculty of Engineering & Technology are to be sent for printing.

Now, therefore, I, Dr. Mohan K. Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, hereby direct as under :-

1) This Direction shall be called "Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering &Technology, Direction, 2011"
2) This Direction shall come into force from the date of its issuance.
3) Schemes of teaching and examinations of III to VIII/X semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

	BRANCH	Appendix No.
1)	Civil Engineering	A
2)	Mechanical Engineering	B
3)	Production Engineering	C
4)	Electrical Engineering (Electronics & Power)	D
5)	Electrical and Electronics Engineering	E
6)	Electrical Engineering (Electrical & Power)	F
7)	Electrical Engineering	G
8)	Electronics & Telecommunication Engineering	H
9)	Electronics Engineering	I
10)	Instrumentation Engineering	J
11)	Computer Science & Engineering	K
12)	Computer Engineering	L
13)	Architecture	M
14)	Textile Engineering	N
15)	Chemical Engineering	O
16)	Chemical Technology (Polymer) (Plastic) Technology	P
17)	Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical) Techology	Q
18)	Information Technology	R
19)	Biomedical Engineering	S

Sd/-
Dr. Mohan K. Khedkar
Vice-Chancellor

*****

B.E. V & VI Semester Prospectus No. 131712

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(Faculty of Engineering & Technology)

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Bachelor of Engineering / Bachelor of Technology

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2) Electronics & Telecommunication Engineering
3) Electronics Engineering
4) Chemical Engineering
5) Polymer (Plastic) Technology
6) Food, Pulp & Paper, Oil & Paint and Petrochemical Technology
7) Textile Engineering
8) Computer Science and Engineering
9) Computer Engineering.

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SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Inprovement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.

Ordinance No. 109	:	Recording of a change of name of a University student in the records of the University.
Ordinance No. 6 of 2008	:	For improvement of Division/Grade.
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi
Registrar
Sant Gadge Baba Amravati University

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be boradly based on the following pattern.

(1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.

(2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.

(3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.

(4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.

(5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

DIRECTION

No. 31/2011 Date : 10-06-2011

Subject :- Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology.

Whereas faculty of Engineering & Technology in its meeting held on 6th June, 2011 vide Item No.39 accepted and recommended schemes of teaching & examinations of semesters III to VIII/X as per Credit Grade System of various branches in the faculty of Engineering & Technology for its implementation from the session 2011-2012 in phase wise manner,

AND

Whereas the schemes of teaching & examinations of semesters III to VIII/X as per Credit Grade System of various branches in the faculty of Engineering & Technology were accepted by the Hon'ble Vice Chancellor u/s Section 14(7) of M.U.Act, 1994 on behalf on Academic Council on 9th April, 2011,

AND

Whereas these schemes of teaching & examinations of various branches as per Credit Grade System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of various branches as pere Credit Grade System inthe faculty of Engineering & Technology are to be implemented fromthe academic session 2011-2012.

AND

Whereas syllabi of various branches in the faculty of Enginering & Technology are to be sent for printing,

Now, therefore, I,Dr.Mohan K.Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers conferred upon me under sub section (8) of Section 14 of the Maharashtra Universities Act,1994 hereby direct as under :-

1) This Direction shall be called "Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches inthe faculty of Enginering & Technology, Direction, 2011".
2) This Direction shall come into force from the date of its issuance.
3) Schemes of teaching and examinations of III to VIII/X semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

BRANCH	Appendix No.
1) Civil Engineering	A
2) Mechanical Enginering	B
3) Production Engineering	C
4) Electrical Engineering (Electronics & Power)	D
5) Electrical and Electronics Engineering	E
6) Electrical Enginering (Electrical & Power)	F
7) Electrical Enginering	G
8) Electronics & Telecommunications Engineering	H
9) Electronics Engineering	I
10) Instrumentation Engineering	J
11) Computer Science & Engineering	K
12) Computer Engineering	L
13) Architecture	M
14) TExtile Engineering	N
15) Chemical Engineering	O
16) Chenmical Technology (Polymer) (Plastic) Technology	P
17) Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology)	Q
18) Information Technolog	R
19) Biomedical Engineering	S

sd/-
Dr.Mohan K.Khedkar
Vice Chancellor

****

DIRECTION

No. : 31 /2012 Date : 19 /07/2012

Subject :- Corrigendum to Direction No.31 of 2011

Whereas,the Direction No.31 of 2011 in respect of the Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology is in existence**,**

AND

Whereas, the schemes of teaching and examinations of III to VIII/X Semesters as per Credit Grade System for the branches Civil Engineering, Mechanical Engineering, Production Engineering,Electrical Engineering(Electronics & Power), Electrical & Electronics Engineering, Electrical Engineering (Electrical & Power), Electrical Engineering, Electronics & Telecommunication Engineering, Electronics Engineering, Instrumentation Engineering, Computer Science & Engineering, Computer Engineering, Architecture, Textile Engineering, Chemical Engineering, Chemical Technology(Polymer)(Plastic) Technology, Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology), Information Technology, Biomedical Engineering were to be implemented from the session 2011-2012 in phase wise manner by the said Direction No. 31 of 2011 as per respective Appendices i.e. AppendixA,B, C,D, E, F, G, H, I,J, K, L,M, N, O, P, Q, R and S,

AND

Whereas, the Academic Council in its meeting held on 05/05/2012 vide Item No. 53 (1) A-R1, C-R-1,D-R1,E-R1,H-R1 and I-R1 has recommended the revised schemes of teaching and examinations of V to VIII/X Semesters as per Credit Grade System for the branches Production Engineering, Electronics & Telecommunications Engineering, Electronics Engineering, Computer Science & Engineering, Computer Engineering,Textile Engineering, Chemical Engineering, Chemical Technology(Polymer)(Plastic) Technology, Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology),

AND

Whereas, the revised Schemes of examinations as per Credit Grade System for the above mentioned branches in the faculty of Engineering & Technology are to be implemented from the academic session 2012-2013 in phase wise manner ,

AND

Whereas, the Schcmes of teaching and examinations of above mentioned branches as per Credit System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas, the process of making the Regulation is likely to take some time,

AND

Whereas, the syllabi of above mentioned branches along with the revised schemes of examinations in the faculty of Engineering & Technology are to be made available for the students admitted during the Session 2012-2013,

Now, therefore , I, Dr.Mohan K.Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University,Amravati in exercise of powers conferred upon me under sub section (8) of Section 14 of the Maharashtra Universities Act,1994, do hereby direct as under : -

1) This Direction shall be called “Corrigendum to Direction No. 31 of 2011”,

2) This Direction shall come into force from the date of its issuance.

3) Revised schemes of teaching and examinatiions of V to VIII/X Semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

BRANCH		**Appendix No.**
1)	Production Engineering	A
2)	Electronics & Telecommunications Engineering	B
3)	Electronics Engineering	C
4)	Computer Science & Engineering	D
5)	Computer Engineering	E
6)	Textile Engineering	F
7)	Chemical Engineering	G
8)	Chemical Technology(Polymer)(Plastic)Technology	H
9)	Chemical Technology (Food, Pulp & Paper,Oil & Paint and Petrochemical Technology)	I

sd/-

Date :- 19 /07/2012

(Mohan K.Khedkar)
Vice Chancellor

****

FOUR YEAR DEGREE COURSE

B.E. PRODUCTION ENGINEERING - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

SEMESTER : FIFTH

APPENDIX- A

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hrs.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5PE01	DESIGN OF MACHINE ELEMENTS	3	1	_	4	4	4	80	20	100	40	_	_	_	_
02	5PE02	TOOL ENGINEERING - I	3	1	_	4	4	3	80	20	100	40	_	_	_	_
03	5PE03	MATERIAL HANDLING SYSTEMS	3	_	_	3	3	3	80	20	100	40	_	_	_	_
04	5PE04	CONTROL SYSTEMS ENGINEERING	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	5FEPE05	FREE ELECTIVE - I	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	5PE06	COMMUNICATION SKILLS	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	5PE07	DESIGN OF MACHINE ELEMENTS - Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5PE08	TOOL ENGINEERING - I - Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5PE09	COMMUNICATION SKILLS - Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
10	5PE10	COMPUTER APPLICATIONS IN PRODUCTION ENGINEERING - Lab.	1	_	2	3	3	_	_	_	_	_	25	25	50	25
		TOTAL	18	3	8	29	26				550				200	
														TOTAL		750

FREE ELECTIVE - I 01) INDUSTRIAL ENGINEERING ii) INDUSTTRIAL SAFETY MANAGEMENT

SEMESTER : SIXTH

Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hrs.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	6PE01	TOOL ENGINEERING - II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	6PE02	METROLOGY & QUALITY CONTROL	3	1	_	4	4	3	80	20	100	40	_	_	_	_
03	6PE03	MACHINE TOOL DESIGN	4	1	-	5	5	3	80	20	100	40	-	-	-	-
04	6PE04	WORK STUDY	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	6FEPE05	FREE ELECTIVE - II	3	_	_	3	3	3	80	20	100	40	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	6PE06	TOOL ENGINEERING - II - Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	6PE07	METROLOGY & QUALITY CONTROL - Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	6PE08	MACHINE TOOL DESIGN - Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
10	6PE9	MINOR PROJECT (MACHINE SHOP PRACTICE)	_	_	3	3	3	_	_	_	_	_	25	25	50	25
		TOTAL	16	3	9	28	25				500				200	
														TOTAL		700

FREE ELECTIVE – II - 01) INDUSTRIAL AUTOMATION 02) ENGINEERING ECONOMICS & ENTREPRENEURSHIP DEVELOPMENT

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering
Branch : Electronics & Telecommunication Engineering
Semester Pattern (Credit Grade System)

APPENDIX - B

Semester : Fifth

Sr. No.	Subject Code	Subject	TEACHING SCHEME HOURS / WEEK Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	EXAMINATION SCHEME THEORY DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	PRACTICAL MAX. MARKS EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5XT1	Electronic Devices & Circuits-II	4	1		5	5	3	80	20	100	40	_	_	_	_
02	5XT2	Power Electronics	4			4	4	3	80	20	100	40	_	_	_	_
03	5XT3	Control System Engineering	4	1		5	5	3	80	20	100	40	_	_	_	_
04	5XT4	Communication Engineering-II	4			4	4	3	80	20	100	40	_	_	_	_
05	5FEXT5	Free Electrive- I	4			4	4	3	80	20	100	40	_	_	_	_
06	5XT6	Communication Skills	2			2	2	2	40	10	50	20				
	Free Elective - I : 1. Consumer Electronics 2. Fibre Optics															
PRACTICALS / DRAWING / DESIGN																
07	5XT7	Electronic Devices & Circuits-II Lab			2	2	1	_	_	_	_	_	25	25	50	25
08	5XT8	Power Electronics Lab			2	2	1	_	_	_	_	_	25	25	50	25
09	5XT9	Communication Engineering-II Lab			2	2	1	_	_	_	_	_	25	25	50	25
10	5XT10	Communication Skills Lab			2	2	1						15	10	25	12
		TOTAL	22	2	8	32	28				550				175	
														TOTAL	725	

Semester : Sixth

Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	6XT1	Digital Integrated Circuits	4			4	4	3	80	20	100	40	_	_	_	_
02	6XT2	Linear Integrated Circuits	4	1		5	5	3	80	20	100	40	_	_	_	_
03	6XT3	Introduction to Microprocessors	4	1		5	5	3	80	20	100	40	_	_	_	_
04	6XT4	Digital Communication	4			4	4	3	80	20	100	40	_	_	_	_
05	6FEXT5	Free Elective -II	4			4	4	3	80	20	100	40	_	_	_	_
		Free Elective - II : 1. Introduction to Wireless Technology 2. Electronic Test Instruments - Analog and Digital.														
PRACTICALS / DRAWING / DESIGN																
06	6XT6	Integrated Circuits Lab			2	2	1	_	_	_	_	_	25	25	50	25
07	6XT7	Introduction to Microprocessors Lab			2	2	1	_	_	_	_	_	25	25	50	25
08	6XT8	Digital Communication Lab			2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	20	2	6	28	25				500				150	
														TOTAL	650	

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering

Branch : Electronics Engineering - Semester Pattern (Credit Grade System)

SEMESTER - FIFTH

APPENDIX - C

Sr. No.	Subject Code	Subject	TEACHING SCHEME HOURS / WEEK Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	EXAMINATION SCHEME THEORY DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	PRACTICAL MAX. MARKS EXNERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5XN1	Electronic Devices & Circuits-II	4	1		5	5	3	80	20	100	40	_	_	_	_
02	5XN2	Power Electronics	4			4	4	3	80	20	100	40	_	_	_	_
03	5XN3	Control System Engineering	4	1		5	5	3	80	20	100	40	_	_	_	_
04	5XN4	Communication Engineering-II	4			4	4	3	80	20	100	40	_	_	_	_
05	5FEXN5	Free Electrive- I	4			4	4	3	80	20	100	40	_	_	_	_
06	5XN6	Communication Skills	2			2	2	2	40	10	50	20				
Free Elective - I : 1. Consumer Electronics 2. Fibre Optics																
PRACTICALS / DRAWING / DESIGN																
07	5XN7	Electronic Devices & Circuits-II Lab			2	2	1	_	_	_	_	_	25	25	50	25
08	5XN8	Power Electronics Lab			2	2	1	_	_	_	_	_	25	25	50	25
09	5XN9	Communication Engineering-II Lab			2	2	1	_	_	_	_	_	25	25	50	25
10	5XN10	Communication Skills Lab			2	2	1						15	10	25	12
		TOTAL	22	2	8	32	28				550				175	
														TOTAL	725	

Semester : Sixth

Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	EXNERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	6XN1	Digital Integrated Circuits	4			4	4	3	80	20	100	40	_	_	_	_
02	6XN2	Linear Integrated Circuits	4	1		5	5	3	80	20	100	40	_	_	_	_
03	6XN3	Introduction to Microprocessors	4	1		5	5	3	80	20	100	40	_	_	_	_
04	6XN4	Radar & Television Engineering	4			4	4	3	80	20	100	40	_	_	_	_
05	6FEXN5	Free Elective -II	4			4	4	3	80	20	100	40	_	_	_	_
Free Elective - II : 1. Introduction to Wireless Technology 2. Electronic Test Instruments - Analog and Digital.																
PRACTICALS / DRAWING / DESIGN																
06	6XN6	Digital Integrated Circuits Lab			2	2	1	_	_	_	_	_	25	25	50	25
07	6XN7	Linear Integrated Circuits Lab			2	2	1	_	_	_	_	_	25	25	50	25
08	6XN8	Introduction to Microprocessors Lab			2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	20	2	6	28	25				500				150	
														TOTAL	650	

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering

Branch : Computer Science & Engineering- Semester Pattern (Credit Grade System)

SEMESTER : FIFTH

APPENDIX - D

Semester :FIFTH																
			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5KS01	Data Communication	4	_	_	4	4	3	80	20	100	40	_	_	_	_
02	5KS02	File Structures & Data Processing	4	1	_	5	5	3	80	20	100	40	_	_	_	_
03	5KS03	System Software	4	_	_	4	4	3	80	20	100	40	_	_	_	_
04	5KS04	Switching Theory & Logic Design	4	1	_	5	5	3	80	20	100	40	_	_	_	_
05	5FEKS05	Free Elective I*	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	5KS06	Communication Skills	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	5KS07	System Software Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5KS08	Switching Theory & Logic Design Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5KS09	Communication Skills Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	21	2	6	29	26				550				150	
														TOTAL	700	

Free Elective I* (i) Data Structures & Algorithms (ii) Data Communication & Networking

Semester :SIXTH																
THEORY																
01	6KS01	Operating Systems	4	1	_	5	5	3	80	20	100	40	_	_	_	_
02	6KS02	Database Systems	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	6KS03	Computing Resources Management	4	_	_	4	4	3	80	20	100	40	_	_	_	_
04	6KS04	Computer Architecture	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	6FEKS05	Free Elective II*	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	6KS06	Professional Ethics	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	6KS07	Operating Systems Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	6KS08	Database Systems Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	6KS09	Computer Lab-II (Hardware Lab)	1	_	2	3	2	_	_	_	_	_	25	25	50	25
		TOTAL	21	2	6	29	26				550				150	
														TOTAL	700	

Free ElectiveII* (i) Database Management System (ii) Software Project Management

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor of Engineering
Branch : Computer Engineering- Semester Pattern (Credit Grade System)
SEMESTER : FIFTH

APPENDIX - E

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5KE01	Data Communication	4	_	_	4	4	3	80	20	100	40	_	_	_	_
02	5KE02	File Structures & Data Processing	4	1	_	5	5	3	80	20	100	40	_	_	_	_
03	5KE03	System Software	4	_	_	4	4	3	80	20	100	40	_	_	_	_
04	5KE04	Switching Theory & Logic Design	4	1	_	5	5	3	80	20	100	40	_	_	_	_
05	5FEKE05	Free Elective I*	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	5KE06	Communication Skills	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	5KE07	System Software Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5KE08	Switching Theory & Logic Design Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5KE09	Communication Skills Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	21	2	6	29	26				550				150	
														TOTAL	700	

Free Elective I* (i) Web Technologies (ii) Object Oriented Programming

Semester :SIXTH																
THEORY																
01	6KE01	Operating Systems	4	1	_	5	5	3	80	20	100	40	_	_	_	_
02	6KE02	Database Systems	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	6KE03	Computing Resources Management	4	_	_	4	4	3	80	20	100	40	_	_	_	_
04	6KE04	Computer Architecture	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	6FEKE05	Free Elective II*	3	_	_	3	3	3	80	20	100	40				
06	6KE06	Professional Ethics	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	6KE07	Operating Systems Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	6KE08	Database Systems Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	6KE09	Computer Lab-II (Hardware Lab)	1	_	2	3	2	_	_	_	_	_	25	25	50	25
		TOTAL	21	2	6	29	26				550				150	
														TOTAL	700	

Free Elective II* (i) Java Programming (ii) Expert Systems

Note : Students will have to opt the free electives offered from other courses of their College / Institution / University Department

Four Year Degree Course in
Bachelor Textile Engineering - Semester Pattern (Credit Grade System)

SEMESTER : FIFTH

APPENDIX - F

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
													MAX. MARKS			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5 TX 01	Yarn Manufacturing -III	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	5 TX 02	Fabric Manufacturing-III	3	1	_	4	4	3	80	20	100	40	_	_	_	_
03	5 TX 03	Textile Testing-I	3	1	_	4	4	3	80	20	100	40	_	_	_	_
04	5 TX 04	Textile Costing and Economics	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	5FETX05	Free Elective-I	3	_	_	3	3	3	80	20	100	40	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
06	5 TX 06	Minor Project-I	_	_	2	2	2	_	_	_	_	_	_	50	50	25
07	5 TX 07	Yarn Manufacturing -III- Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5 TX 08	Fabric Manufacturing-III- Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5 TX 09	Textile Testing-I- Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	15	4	8	27	24				500				200	
														TOTAL	700	

Free Elective-I:- (i) Technical Textiles (ii) Fashion & Clothing Science

Semester : Sixth																
THEORY																
01	6 TX 01	Fabric Structure	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	6 TX 02	Advanced Yarn Manufacturing Technology	3	1	_	4	4	3	80	20	100	40	_	_	_	_
03	6 TX 03	Textile Testing-II	3	_	_	3	3	3	80	20	100	40	_	_	_	_
04	6 TX 04	Apparel Merchandising	3	_	_	3	3	3	80	20	100	40	_	_	_	_
05	6FETX05	Free Elective-II	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	6 TX 06	Communication Skill	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	6 TX 07	Minor Project-II	_	_	2	2	4	_	_	_	_	_	25	25	50	25
08	6 TX 08	Fabric Structure- Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	6 TX 09	Advanced Yarn Manufacturing Technology- Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
10	6 TX 10	Textile Testing-II- Lab.	_	_	2	2	1	_	_	_	_	_	25	25	50	25
11	6 TX 11	Communication Skill-Lab.	--	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	17	2	10	29	27				550				250	
														TOTAL	800	

Free Elective-II:- (i) Computer Aided Textile & Fashion designing (ii) Fashion Technology

* Notes :
1) Student has to undergo inplant training for 15 days in any textile manufacturing unit
2) Students will have to opt the free electives offered from other courses of their College / Institution / University Department

Four Year Degree Course in Bachelor of Engineering
Branch : Chemical Engineering - Semester Pattern (Credit Grade System)

SEMESTER - FIFTH

APPENDIX - G

Sr. No.	Subject Code	Subject	TEACHING SCHEME: HOURS / WEEK: Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	EXAMINATION SCHEME: THEORY: DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	PRACTICAL: MAX. MARKS: EXTERNAL	MAX. MARKS: INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5CH01	Heat Transfer	4	_	_	4	4	3	80	20	100	40	_	_	_	_
02	5CH02	Chemical Engineering Process-I (Inorganic Chemical Technology)	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	5CH03	Economics & Management	4	_	_	4	4	3	80	20	100	40	_	_	_	_
04	5CH04	Material Science & Engineering	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	5FECH05	Free Elective-I	3	_	_	3	3	3	80	20	100	40				
06	5CH06	Communication Skills	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	5CH07	Heat Transfer-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5CH08	Material Science & Engineering-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5CH09	Communication Skills- Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	20	1	6	27	24				550				150	
														TOTAL		700
		Free Elective-I 1) Air Pollution Control 2) Risk & Safety Management in Industries.														
Semester : Sixth																
THEORY																
01	6CH01	Chemical Engineering Operation - II (Mass Transfer - I)	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	6CH02	Chemical Engineering Process-II (Organic Chemical Technology)	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	6CH03	Computer Programming & Applications	3	1	_	4	4	3	80	20	100	40	_	_	_	_
04	6CH04	Process Equipment Design & Drawing	4	_	_	4	4	3	80	20	100	40	_	_	_	_
05	6FECH05	Free Elective II	3	_	_	3	3	3	80	20	100	40	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
06	6CH06	Chemical Engineering Operation - II (Mass Transfer - I)-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
07	6CH07	Computer Programming & Applications-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	6CH08	Minor Project	_	_	2	2	4	_	_	_	_	_	25	25	50	25
		TOTAL	17	2	6	25	25				500				150	
														TOTAL	650	

Free Elective-I 1) Renewable Energy Sources 2) Water Technology

Note : Students will have to opt the free electives offered from other courses of their college / Institution / University Department.

Four Year Degree Course in Bachelor Technology

Branch : Polymer (Plastic) Technology Semester Pattern (Credit Grade System)

APPENDIX - H

Semester : FIFTH

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS EXTERNAL	MAX. MARKS INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY																
01	5PP01	Heat Transfer	4	_	_	4	4	3	80	20	100	40	_	_	_	_
02	5PP02	Polymer Materials	4	_	_	4	4	3	80	20	100	40	_	_	_	_
03	5PP03	Engineering Plastics & Speciality Polymers	3	1	_	4	4	3	80	20	100	40	_	_	_	_
04	5PP04	Instrumentation & Control	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	5FEPP05	Free Elective-I	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	5PP06	Communication Skill	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	5PP07	Heat Transfer-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5PP08	Polymer Materials-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5PP09	Instrumentation & Control-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
10	5PP10	Communication Skill-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
		TOTAL	19	2	8	29	25				550				200	
													TOTAL			750

Free Elective-I 1) Polymer Science and Technology 2) Rubber Technology

Semester : Sixth																
THEORY																
01	6PP01	Chemical Engineering Operation-II (Mass Transfer)	3	1	_	4	4	3	80	20	100	40	_	_	_	_
02	6PP02	Elastomer Technology	3	1	_	4	4	3	80	20	100	40	_	_	_	_
03	6PP03	Computer Programming & Applications	3	1	_	4	4	3	80	20	100	40	_	_	_	_
04	6PP04	Polymer Engineering Thermodynamics	3	_	_	3	3	3	80	20	100	40	_	_	_	_
05	6FEPP05	Free Elective-II	3	_	_	3	3	3	80	20	100	40	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
06	6PP06	Chemical Engineering Operation-II (Mass Transfer)-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
07	6PP07	Elastomer Technology-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	6PP08	Computer Programming & Applications-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	6PP09	Minor Project	_	_	2	2	4	_	_	_	_	_	25	25	50	25
		TOTAL	15	3	8	26	25				500				200	
													TOTAL			700

Free Elective-II 1) Polymeric Materials 2) Paint and Surface Technology

Note : Students will have to opt the free electives offered from other courses of their College / Institution / University Department

Four Year Degree Course in Bachelor of Technology

Branch : Food, Pulp & Paper, Oil & Paint and Petrochemical Technology - Semester Pattern (Credit Grade System)

Semester : FIFTH **APPENDIX - I**

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK					THEORY					PRACTICAL			
													MAX. MARKS			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D	Total HOURS/WEEK	CREDITS	DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	EXTERNAL	INTERNAL	TOTAL	MIN. PASSING MARKS
THEORY		Semester : Fifth														
01	5 CT 01	Heat Transfer	3	_	_	3	3	3	80	20	100	40	_	_	_	_
02	5 CT 02	Mechanical Operations	3	_	_	3	3	3	80	20	100	40	_	_	_	_
03	5 CT 03	Chemical Engineering Thermodynamics	3	_	_	3	3	3	80	20	100	40	_	_	_	_
04	5 FT 04	Food Technology - II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
	5 PT 04	Pulp & Paper Technology -II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
	5 OT 04	Oil & Paint Technoloogy -II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
	5 PC 04	Petrochemical Technology - II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	5 FECT 05	Free Elective - I	3	_	_	3	3	3	80	20	100	40	_	_	_	_
06	5 CT 06	Communication Skills	2	_	_	2	2	2	40	10	50	20	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
07	5 CT 07	Heat Transfer -Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	5 CT 08	Mechanical Operation-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	5 CT 09	Chemical Engineering Thermodynamics-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
10	5 FT 10	Food Technology - II-Lab	_	_	4	4	2	_	_	_	_	_	25	25	50	25
	5 PT 10	Pulp & Paper Technology -II-Lab	_	_	4	4	2	_	_	_	_	_	25	25	50	25
	5 OT 10	Oil & Paint Technoloogy -II-Lab	_	_	4	4	2	_	_	_	_	_	25	25	50	25
	5 PC 10	Petrochemical Technology - II-Lab	_	_	4	4	2	_	_	_	_	_	25	25	50	25
11	5 CT 11	Communication Skills-Lab	_	_	2	2	1	__	_	_	_	__	25	25	50	25
		TOTAL	17	1	12	30	25				550				200	
														TOTAL	750	
Free Elective - I : 1) Environmental Impact : Risk Assessment and Management 2) Economics and Management																
THEORY		**Semester - Sixth**														
01	6 CT 01	Process Equipment - Design & Drawing	4	_	_	4	4	3	80	20	100	40	_	_	_	_
02	6 CT 02	Computer Programming & Applications	3	1	_	4	4	3	80	20	100	40	_	_	_	_
03	6 CT 03	Instrumentation & Control	4	_	_	4	4	3	80	20	100	40	_	_	_	_
04	6 FT 04	Food Technology -III	3	1	_	4	4	3	80	20	100	40	_	_	_	_
	6 PT 04	Pulp & Paper Technology -III	3	1	_	4	4	3	80	20	100	40	_	_	_	_
	6 OT 04	Oil & Paint Technoloogy -III	3	1	_	4	4	3	80	20	100	40	_	_	_	_
	6 PC 04	Petrochemical Technology -III	3	1	_	4	4	3	80	20	100	40	_	_	_	_
05	6 FECT 05	Free Elective - II	3	1	_	4	4	3	80	20	100	40	_	_	_	_
PRACTICALS / DRAWING / DESIGN																
06	6 CT 06	Process Equipment Design & Drawing-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
07	6 CT 07	Instrumentation & Control-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
08	6 CT 08	Computer Programming & Application-Lab	_	_	2	2	1	_	_	_	_	_	25	25	50	25
09	6 CT 09	Minor Project	_	_	2	2	2	_	_	_	_	_	25	25	50	25
		TOTAL	17	3	8	28	25				500				200	
														TOTAL	700	

Free Elective - II : 1) Introduction to Membrane Technology 2) Renewable Energy Sources 3) Chemical Technology

Note : Students will have to opt the free electives offered from other courses of their College / Institution / University Department

SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
PRODUCTION ENGINEERING EXAM.
SEMESTER PATTERN (C. G. S.)
FIFTH SEMESTER

5PE01 DESIGN OF MACHINE ELEMENTS

Lecture : 04 Hrs/ w **Internal Assessments:** 20
Tutorial : 01 Hrs/ w **University Exam:** 80
Credits : 05 **Theory Paper (Hrs.) :** 04

Course Objectives:

- To study the different types load considerations and design aspects of various machine members.
- Develop and evaluate alternatives for mechanical systems.
- To synergize forces, moments, torques, stress and strength information.
- To develop ability to analyze, design and/or select machine elements - with attention to safety, reliability, and societal and fiscal aspects.
- Design shafting and specify appropriate keys and couplings.
- Design springs, common welded and bolted connections.

SECTION-A

UNIT-I : Introduction to M/c design, Design procedure, factors affecting M/c design, types of stresses in machine members compound stresses, theories of material failure. Factor of safety, properties and selections of material, designation of material as per I.S.I.; elementary ideas of inertia and thermal stresses. Design of levers and threaded fastness. (12)

UNIT- II: Design of Joints: Pin, Cotter, Knuckle, etc., Riveted and Welded joints. (12)

SECTION-B

UNIT III: 1. Design procedure for parts subjected to alternating, shock and impact loads. Stress concentration, Endurance limit.
2. Design of Helical, leaf and spiral spring.
3. Design of Keys and Splines. (12)

UNIT-IV: 1. Design of pressure vessels and pipes.
2. Design of shafts, spindle and coupling.
3. Design of columns and frames with direct and eccentric loading. (12)

TEXT BOOKS :

1. Design of Machine Elements, V. B. Bhandari, 3 Ed. (Tata McGraw-Hill Publishing Company Ltd.)
   ISBN: 9780070681798
2. Mechanical Engineering design, J. E. Shigley, Mitchell, 3 Ed(McGraw- Hill Publishing Co. Ltd)
   ISBN:9780071441633
3. Elements of Machine Design, N. C. Pandya and C. S. Shaha, 15 Ed., (Charotar Publishing House)
   ISBN:81-85-594-42-2
4. A Text Book of Machine Design, R. S. Khurmi, (S. Chand) ISBN: 8121925371
5. Machine Design, R. K. Jain, (Khanna Publishers.)

REFERENCE BOOKS

1. Machine Tool Design, N. K. Mehta, (Tata McGraw-Hill Publishing Company Ltd.)
2. Design Data Books : a) Shivalkar, Kulkarni b) K.Mahadevan c) N.R.Chakrabarti
3. Design of Machine Elements, Dbrovalsky (MIR Publisher)
4. Design of Machine Elements by M. F. Spoots, T.E.Shoup 4 Ed. (PHI) ISBN: 0-87-692-177-2
5. Computer Aided Analysis and Design of Machine Elements by Dukki Patti, Rao, Bhat , (New Age, Delhi)
6. CMTI Machine Tool Design Handbook (TMH)
7. Machine Design by Black and Adams (McGraw-Hill Publishing Company Ltd)

5PE02 TOOL ENGINEERING – I

Lecture : 03 Hrs/ w **Internal Assessments:** 20
Tutorial : 01 Hrs/ w **University Exam:** 80
Credits : 04 **Theory Paper (Hrs.) :** 03

Course Objectives:

- To meet the requirements of industry in the fields of tool design and manufacturing
- To train students in designing different tools like Single point Tool, Circular and Flat form tool, drill, reamer and broach.
- Student should have the basic knowledge of metal cutting process (machining). Economics of Machining.

SECTION-A

UNIT-I : Mechanics of metal cutting : Common features of machining processes. Basic wedge action of cutting tools, mechanism of chip formation; type of chips. Concept of cutting speed, feed, depth of cut, shear angle, velocity relation, shear strain. Merchant theory of metal cutting, cutting forces and power, metal removal rate, energy consideration in metal cutting. (8)

UNIT-II : Single point cutting tool : Classification, systems of nomenclature, design of single point tool, cutting speeds, feeds and tool angles, chip breakers, form tools, classification, design of flat & circular from tool, clamping arrangement of form tools.

(7)

UNIT- III: i) Drills: Types, geometry of twist drill, cutting variables, and chip formation, forces and torque in drilling.

ii) Milling cutters : Conventional & climb milling, types of cutters, geometry of plain milling cutter, face milling cutter, machining process and cutting variables, force acting on plain milling cutter. Design considerations in milling cutter.

iii) Reamers: Types, tool geometry, tolerance, design considerations. (7)

SECTION-B

UNIT-IV: Broaches : i) Cutting process in broaching, geometric elements of broach teeth, cutting variables in broaching classification of broach design of broaches, cutting forces in broaching.

ii) Gear Cutting Tools: (Different types) gear shaper cutter, gear hob and their geometry.

iii) Thread cutting tools: Geometry of tapes & dies.

iv) Tools for NC/CNC machines. (7)

UNIT-V: Tool Wear, Tool Life, Machinability and Coolants: Wear mechanism, type of tool wear and chipping of different tool material, tool failure criteria, direct and indirect. Tool life equation, effect of process parameters on tool life, tool life tests-machinability, criteria for machinability, distribution of heat generated in metal cutting, functions of cutting fluids, types and selection of cutting fluid. (8)

UNIT-VI: Tool Materials and Economics of Machines: Properties and applications of various tool materials HSS, cast cobalt alloys, Carbides, ceramics, diamonds, UCON, CBN, Recent tool materials. Classification of carbides. Component of machining costs, optimisation criteria, high efficiency zone, tool life for minimum cost of production and for maximum production rate.

Surface Finish : effect of machining parameters, surface finish expression, cost of surface finish. (8)

TEXT BOOKS :

1) Metal Cutting Theory and Cutting Tool Design : MIR Pub. by Arshinov.
2) Fundamentals of Metal Cutting and Machine Tools by WFL, Juneja.

REFERENCE BOOKS :

1) Production Technology, By HMT
2) Metal Cutting Theory and Practice : Central Book Pub. by A. Bhattacharya.
3) Production Technology : PHI Astme.

5PE03 MATERIAL HANDLING SYSTEMS

Lecture : 03 Hrs/ w	**Internal Assessments:** 20
Tutorial : _____	**University Exam:** 80
Credits : 03	**Theory Paper (Hrs.) :** 03

Course Objectives:

- This course will cover the different classifications of material handling equipment. Within each of these classifications, we will discuss the alternate types of equipment available and what situations are appropriate for applying the different variations.
- A special emphasis will be on the application of material handling equipment in a warehouse environment.

  Distribution activities are becoming a focus for many industrial engineers and the ability to apply and evaluate material handling equipment is an essential part of evaluating and managing a storage facility.

SECTION-A

UNIT-I : Introduction, definition of material handling, its relationship with plant layout. Types of industries, related material handling equipment. Design of plant layout. Site selection for plant. (6)

UNIT-II: Principles of mechanical handling, types of material handling equipments and their field of applications, selection and specification of equipments. Screw conveyor. Introduction, calculation of HP of motor used, characteristics and field of application of screw conveyers, determination of application of screw conveyers of salient dimensions and power requirements. (8)

UNIT- III: Belt conveyers : Introduction, types of drives used for belt conveyers, methods of maintaining belt tensions. Optimization of cross sectional area of belt conveyers supported on (a) two roller system (b) three roller system, determination of salient dimensions and power requirements. (8)

SECTION-B

UNIT-IV: Types of cranes and their application : Electric Over head Travelling (E.O.T.) cranes, types of EOT cranes and their applications, design of mechanical system used for :

a) Cross travel of the crane,

b) Longitudinal travel of the crane and

c) Hoisting and lowering motion of the crane load.

Design of breaking, system of various types of EOT cranes, functions of limit switches used EOT cranes. (8)

UNIT-V: Introduction, working principles, and field of applications of the following mechanical handling equipments (No mathematical treatment is contemplated)

i) Pneumatic conveyers

ii) Hydraulic conveyers

iii) Escalators

iv Robots in material handling. (8)

UNIT-VI: A) Introduction, working principles and field of applications of following mechanical material handling equipments. (No mathematical treatment is contemplated)

i) Ladle Crane

ii) Electric Lifts

iii) Skip Hoists

iv) Fork Lift Trucks

v) Winches

B) Repairs and maintenances of material handling equipments and hazards with M.H.E. (7)

TEXT BOOKS :

1) Material Handling System Design : James Apple
2) Material Handling Equipments : Alexandrov
3) Introduction to Material Handling : Siddhartha Ray Publish by New Age Int. Pub. ISBN: 81-224-2099-0

REFERENCE BOOKS :

1) Material Handling Hand Book Published By JOHN WILLEY & Sons.
2) Plant Layout and Material Handling : James Apple 3RD Ed ISBN: 047107171-4 (JOHN WILLEY & Sons)
3) Plant Layout and Material Handling : National Productivity Council
4) Handbook of Material Handling, By R Robinson, Chichester, ISBN: 0-470-20098-7

5PE04 CONTROL SYSTEMS ENGINEERING

Lecture : 03 Hrs/ w
Tutorial : 01 Hrs/ w
Credits : 04

Internal Assessments: 20
University Exam: 80
Theory Paper (Hrs.) : 03

Course Objectives:

- To develop the student's skills in applying Laplace transform to obtain transfer functions.
- To develop student's skills associated with modeling dynamic systems through block diagrams and signal flow graphs.
- To develop student with knowledge of state variable models of feedback control systems.
- To provide the student with skills in analyzing characteristics of dynamics systems and measures of performances.
- To provide the student with analysis skills associated with the assessment of system stability.
- To provide the student with the ability to perform root locus analysis.

SECTION-A

UNIT-I : Introduction, system concept, open and closed loop systems, mathematical models, transfer functions, formulation of mathematical model of mechanical, hydraulic, thermal and simple electrical systems. Concept of block diagram, block diagram algebra, signal flow graphs. (7)

UNIT-II : Basic control actions: proportional, integral and PID controllers, principle of working and characteristics performance of control system and components for the following types :- position, velocity, temperature, pressure, force, torque, flow level etc. (for mechanical, hydraulic, pneumatic and electrical systems).

Study of important automatic speed systems in various prime movers. (8)

UNIT- III: Transient Response Analysis: - method of analysis transient and steady state response of first, second and higher order systems, impulse and step input responses. Transient response specification, Steady state errors and error constant. (7)

SECTION-B

UNIT-IV : Concept stability, necessary condition for stability, Rauths stability criterion, root locus concept, construction of root loci, systems with transportation log. (8)

UNIT-V : Logarithmic and polar plots, Nyquist stability criterion; stability analysis, determination of system parameter from experimental results. (8)

UNIT-VI: Design and compensation techniques : introduction, preliminary design considerations; lead and log compensations. (7)

TEXT BOOKS:

1) Modern Control Engineering : Katsuhiko, Ogata Prentice Hall.
2) Automatic Control Engineering : Francis H. Raven, McGraw Hill
3) Feedback Control Systems By U A Bakshi, Pearson

REFERENCE BOOKS:

1) Control System Engineering : I.J.Nagrath & M.Gopal, Wesley Eastern.

2) Automatic Control System : Kuo B.C.
3) Automatic Control Introduction : Webb C.R.
4) Control System Engineering : Dorf R.C.

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5FEPE05 FREE ELECTIVE - I
(1) INDUSTRIAL ENGINEERING

Lecture : 03 Hrs/ w	**Internal Assessments:** 20
Tutorial : _____	**University Exam:** 80
Credits : 03	**Theory Paper (Hrs.) :** 03

Course Objectives:

- This course studies the definition of industrial engineering and the evolution of its approach in solving problem as well as discussing the manufacturing system which use as an object of the study. The course objective is to introduce the discipline and profession of industrial engineering.

SECTION - A

Unit I: The Purpose, Fundamentals and Evolution of Industrial Engineering. The Role and Career of the Industrial Engineer in the Modern Organization. The Industrial Engineer as Manager. Industrial Engineering in Government, Service Industry Applications. **(7)**

Unit II: The Concept and Importance of Productivity, Productivity Improvement through Business Process Reengineering, Total Productivity Management, Performance Management; A Key Role for Supervisors and Team Leaders, Managing Change through Teams, Involvement, Empowerment, and Motivation. **(7)**

Unit III: Methods Engineering and Workplace Design, Continuous Improvement, Work Design and Flow Processes for Support Staff, Setup Time Reduction, Measurement of Work, Purpose and Justification of Engineered Labor Standards, Standard Data Concepts and Development, Developing Engineered Labor Standards, Allowances, Computerized Labor Standards, Implementation and Maintenance of Engineered Labor Standards. **(8)**

SECTION - B

Unit IV: Ergonomics, Resources, Designing, Implementing, and

Justifying an Ergonomics Program, Ergonomic Consumer Product Design, Manufacturing Ergonomics, Ergonomics in the Office Environment, the Interface between Production System Design and Individual Mechanical Exposure. Occupational Safety Management and Engineering. **(7)**

Unit V: Quantitative Approach to the Site Selection Process, Facilities Layout and Design, A Participatory Approach to Computer-Aided Workplace Design, Planning a Manufacturing Cell, Scheduling and Inventory Control of Manufacturing Systems, An Introduction to Supply Chain Management, Production Scheduling. **(8)**

Unit VI: Industrial Engineering Support for Materials Management, Materials Handling, Warehouse Management, Distribution Systems, Inventory Management and Control. Product Design and Quality Management, Product Development, Design for Manufacture and Assembly, Value Management. World-Class Manufacturing: An Industrial Engineering View. **(8)**

TEXT BOOKS:

1. Dr.B.Kumar, Industrial Engineering; Khanna Publishers.
2. Martand Telsang, Industrial Engineering and Production Management; S.Chand.ISBN:81-219- 1773-5

REFERENCES BOOKS:

1. Turner, W.C., et. Al, 1993, "Introduction to Industrial and System Engineering", Prentice Hall.
2. Hicks, P.E., 1994, "Industrial Engineering and Management: a New Perspective", McGraw-Hill, Inc.
3. Eide, et. Al., 2002, "Engineering Fundamental and Problem Solving", John Wiley & Sons.

5FEPE05 FREE ELECTIVE - I
(2) INDUSTRIAL SAFETY MANAGEMENT

Lecture : 03 Hrs/ w	**Internal Assessments:** 20
Tutorial : _____	**University Exam:** 80
Credits : 03	**Theory Paper (Hrs.) :** 03

Course Objectives:

The course will allow you to realize the following objectives-

- Develop range of competencies necessary in the field of safety management
- Knowledge and understanding on the subject and skills needed for different situations
- Risk assessment, health and safety regulations
- Develop skills in communication, management and critical thinking

- Plan of conduct during and after investigations depending on sensitivity of subject matter
- Identify and analyze broadly defined problems, evaluate strategies

SECTION - A

UNIT - I : Concepts : History of Safety movement – general concepts of management – planning for safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety-budgeting for safety-safety policy. (7)

UNIT- II : Techniques-Incident Recall Technique (IRT) – disaster control – damage control-job safety analysis – safety survey – safety inspection – safety sampling – motivating techniques – evaluation of performance of supervisors on safety-safety posters – safety displays – safety pledge – safety Lab. (8)

UNIT III : Components of safety audit – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor. (8)

SECTION – B

UNIT-IV : Concept of an accident – Cost of accident- reportable and non reportable accidents – reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents – departmental accident reports – documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident – factories act – safety health. (8)

UNIT V : Safety Performance Monitoring : Calculation of accident indices – frequency rate – severity rate – frequency severity incidence – incident rate – accident rate – safety “t” score – problems. (7)

UNIT VI: Safety Education And Training: Importance of training-identification of training needs-training methods - programmes-seminars – conferences – competitions – motivation – communication - role of government agencies and private consulting agencies in safety training – awards – celebrations. (7)

TEXT BOOKS:

1. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York.

2. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay.

REFERENCE BOOKS:

1. Dan Petersen, “Techniques of Safety Management”, McGraw-Hill Company, Tokyo.
2. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey.
3. “Safety and Good House Keeping”, N.P.C., New Delhi.
4. “Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago.
5. Lees, F.P., “Loss Prevention in Process Industries” Butterworth publications, London, 2nd edition.
6. John Ridley, “Safety at Work”, Butterworth & Co., London.

5PE06 COMMUNICATION SKILLS

Lecture : 02 Hrs/ w	**Internal Assessments:** 10
Tutorial : _____	**University Exam:** 40
Credits : 02	**Theory Paper (Hrs.) :** 02

UNIT-I: Comprehension over an unseen passage.
Comprehension - A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.
Comprehension - B - Structure study :- Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.
Active and passive forms, negative and interrogative, punctuation and capitalization. (8)

UNIT-II : Theoretical background - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectively and subject content. Non-verbal communication, types of graphics and pictoral devices. (8)

UNIT- III: Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. Methodology of conduction of meetings, seminars, symposia, conference and workshop. (8)

BOOKS RECOMMENDED :

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
2) Cbrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
3) Raman Sharma "Technical Communication", Oxford University Press.
4) F. Frank Candlin ; General English for Technical Students, University of London Press Ltd.

5PE07 DESIGN OF MACHINE ELEMENTS – Lab.

Practical : 02 Hrs/ w **Practical Term Work:** 25
Tutorial : ____ **Practical / Oral Exam:** 25
Credits : 01

Course Objectives:

- Apply the study of the different types load considerations and design aspects of various machine members.
- Apply the ability to analyze, design and/or select machine elements - with attention to safety, reliability, and societal and fiscal aspects.
- Design shafting and specify appropriate keys and couplings.
- Design springs, common welded and bolted connections.

TERM WORK

Any eight of the following design. (Standard components shall be selected from relevant I.S. codes and Design Data Handbooks for the exercises given below.)

1. Design of cotter joint.
2. Study of Engineering Materials, their applications and selection as per different standards used in practice.
3. Design of Knuckle joint.
4. Design of circumferential/longitudinal riveted joint of boiler.
5. Design of springs.
6. Design of rigid flange coupling.
7. Design of flexible coupling (Bush pin type)
8. Design of lever of a safety valve.

9. Design of eccentrically loaded bracket.
10. Design of pipe and pipe joints subjected to internal pressure.
11. Design of shaft carrying one pulley and supported in two bearing.
12. Design of Coupling and Detailed Working drawings with assembly.
13. Design of bolted, riveted and welded joints for transverse and eccentric loading.
14. Design of Gear Drive involving Gears, Shafts, and Keys with working drawings.
15. One assignment using CAD package on any one of the exercises.

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

5PE08 TOOL ENGINEERING – I – Lab.

Pra
Practical : 02 Hrs/ w **Practical Term Work:** 25
Tutorial : ____ **Practical / Oral Exam:** 25
Credits : 01

Course Objective:

- Student should have the basic knowledge of how to design various tools used for machining (metal cutting), Student should be able to design Single point tool, Circular and flat form tools, drill, broach. Student should also have the knowledge of selecting proper tool which will give the desired quality in the most economical way.

PRACTICALS :

At least six experiments based on above syllabus as given below:

1) Measurement of forces on lathe tool dynamometer.
2) Drawing and design of single point tool.
3) Drawing and design of circular form tool for two jobs.
4) Drawing and design of flat form tools.
5) Design of broach.
6) Study of geometry of drill and reamer and measurement of axial thrust and torque by drill tool dynamometer.
7) Study of geometry of taps and dies.
8) Study of geometry of gear cutting tools.

A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be vivavoce based on above practical and the syllabus of the course.

5PE09 COMMUNICATION SKILLS – Lab.

Practical : 02 Hrs/ w **Practical Term Work:** 25
Tutorial : ____ **Practical / Oral Exam:** 25
Credits : 01

Course Objective:

- On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and communication for technical English language, actively participate in group discussions and interviews and bit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and action. The sample list of experiments is given below. This list can be used as guideline for problem statements but f scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.
  1. Assignments and tests for vocabulary building
  2. Technical report writing
  3. Group discussions
  4. Interview techniques
  5. Projects and tasks such as class news letter
  6. Writing daily diaries and letters
  7. Interactive language laboratory experiments.

TEXT BOOKS :

1) Norman Lewis : Word Power Made Easy
2) Ghosh: "Technical Communication", Oxford University ress.
http://www.teachingenglish.org.uk

5PE10 COMPUTER APPLICATIONS IN PRODUCTION ENGINEERING – Lab.

Practical : 02 Hrs/ w **Practical Term Work:** 25
Lecture : 01 Hrs/ w **Practical / Oral Exam:** 25
Credits : 03

Course Objective: Student will

- Understand and practical knowledge of 2D and 3D modeling of various part models.
- Have a good understanding of the various kinds of databases and the support they provide to different levels of management.
- Be able to use SQL with confidence to implement a relational database, and to maintain and access data in relational databases
- Be able to use Word, Excel and Presentation documentations.
- Have a good understanding of various Numerical, Statistical Analysis and its plots.

UNIT – I: MODELING SOFTWARE:

1) Sketching, selection of sketch plane, creating feature on work plane, extrude, dimensioning sketches, constraining sketches.
2) Create Rectangle, Circle, and Polygons. Extrude these to make box, cylinder & prism and dimension the above part, change size by editing dimensions & using constraints.
3) Create various drawing views of the 3-D parts.
4) Extrudes to face/plane, intersect, face draft, 3D rounds, 3D fillets & 3D chamfers, setting & modifying feature dimensions, history based part modification.
5) Use extrudes commands to make holes through the above objects. Also face drafts a part on another part.
6) Create 3-D rounds and fillets on box corners and Use history to modify above feature and their dimensions.

UNIT II : DBMS SOFTWARE:

1) Design and draw an ER diagram using standard notations for given problem definition
2) Convert given ER diagram into Database Tables.
3) Create Database Tables and Indices in back end Database like / MS ACCESS / ORACLE / SQL Server / My SQL using SQL DDL statements and applying all required constraints on Tables and/or Tuples. *(Create at least 03 tables using all types of possible constraints, and relationship (foreign key) between them.)*
4) Use SQL DML statements such as INSERT, UPDATE, DELETE to insert the data into tables and to update/delete the data inserted into/from tables if required.
5) Write and execute SQL queries to extract information from the tables.
6) Study on any two of the following:
   a) Inter-organizational and global information systems
   b) Functional and enterprise system
   c) Intelligent systems in Business.
   d) Electronic Commerce (E-Commerce).

UNIT III: NUMERICAL & STATISTIC ALANALYSIS SOFTWARE (MATLAB / PYTHON):

1) Matrices and array manipulation;
2) Solution of linear algebra and nonlinear systems;
3) Input/output and simple plotting (2D and 3D plot)

4) Data analysis and Statistics;
5) Initial value and boundary value problems;
6) Interpolation (global, piecewise, regression);
7) Numerical integration algorithms;

UNIT IV: OFFICE (Microsoft / OpenOffice):

1) Word processing: MS-Word, word basics, formatting text and documents, working with header and footer, footnotes, endnotes, tables and sorting, graphics, mail merge and macros.
2) Spreadsheets and their uses in business, Excel basics, rearranging worksheets, excel formatting techniques, using functions, chart features and working with graphics in excel.
3) Power Point: Basics, working with texts and graphics in Power Point.

TERM WORK:

1) Minimum Two practicals from each on Unit I, II and III
2) Prepare a mail merge application using Word and Excel.
3) Prepare a Presentation on any one Topic from V semester syllabus A Journal / Report on experiments conducted shall be submitted by each student. Using. and presented by using .
   Practical examination shall be viva-voce based on above units, taken jointly by internal & external examiner.

TEXT BOOKS:

1) "MASTERING CAD CAM" By Ibrahim Zeid, 2005, TMH, ISBN 0-07-059411-2
2) "DATBSE MANAGEMENT AND ORACLE PROGRAMMING", By S S KHANDARE, 2004, S CHAND & Co. NEW DELHI , ISBN 81-219-2283-6
3) "Getting Started with MATLAB, By Rudra Pratap, 2010, Oxford University Press, NEW DELHI, ISBN 978-0-19-806919-5

REFERENCE BOOKS:

1) "INTRODUCTION TO DATABASE MANAGEMENT", By Dr Madhulika Jain, 2002, BPB PUBLICATION, NEW DELHI, ISBN 81-7656-638-1
2) "Pro/Engineering Wildfire for Engineers and Designers" By Prof. Sham Tickoo, 2003, Wiley Dreamtech India Pvt. Ltd. New Delhi, ISBN 81-7722-413-1

SIXTH SEMESTER

6PE01 TOOL ENGINEERING - II

Lecture : 04 Hrs/ w	**Internal Assessments:** 20
Tutorial : 01 Hrs/ w	**University Exam:** 80
Credits : 05	**Theory Paper (Hrs.) :** 03

Course Objective:

- Student should have the basic knowledge of how to design various tools used for machining (metal cutting), Student should be able to design jigs, fixtures, press tools and dies. Student should also have the knowledge of selecting proper jigs, fixtures and forming process / tools, which will give the desired quality in the most economical way

SECTION-A

UNIT-I & II : Jigs & Fixtures : Design economics, principles of locations, types of location, preparation of jamming problem of chips & dust in location, use of dowels, redundant location, principles of clamping, types of clamps, power clamping drill bushes, types of drill jigs and their design, milling fixtures, turning fixtures, grinding & broaching fixtures, indexing devices in jigs of fixtures. (14)

UNIT-III : Rolling : Principle, classification of rolling mill, construction of rolling mill, layout of rolling mills, maximum permissible reduction in one pass, no. passes, roll pass design, box pass and oval pass, defects in rolling, sectional rolling passes, rolling torque of power.

Extrusion : process fundamental; forward, backward, impact, hydrostatic extrusion, pressure required in extrusion. (10)

SECTION-B

UNIT-IV & V : Press Tools : Classification of presses, shear action in die cutting operation, clearance, cutting forces, shear on punch and die, centre of pressure, classifications of cutting operation, operating of metals, drawing fundamental, types of die construction, function of nomenclature of die components, planning for cupping operation.

Miscellaneous dies : Horn die, cam action die, rubber & bulging, sub-pressing die. (14)

UNIT-VI: Forging : process fundamental, classification & schedule of forging equipment, classification of forging process, type of forging product, perform stages & design of product for close die forging, shape of perform stages for class III forgings, strength of forged component, trim ting, mounting of dies, non classified forgings upset forging. (10)

TEXT BOOKS:

1) PRODUCTION ENGINEERING By P C Sharma
2) Tool Design - Donaldson, T.M.H.

REFERENCE BOOKS:

1) An Introduction Jig & Tool Design - EKBs, T.M.H.A., Kempster.

2) Jigs & Fixtures - P.H.Joshi, T.M.H.
3) Rolling Practice - Burtsev, MIR.
4) Techniques Press Working Sheet Metal - Eary, P.H. Inc.
5) Fundamentals of Tool Design - P.H.Astme.
6) Manufacturing Technology - P.N.Rao, T.M.H.

6PE02 METROLOGY AND QUALITY CONTROL

Lecture : 03 Hrs/ w	**Internal Assessments:** 20
Tutorial : 01 Hrs/ w	**University Exam:** 80
Credits : 04	**Theory Paper (Hrs.) :** 03

Course Objectives:

- Future manufacturing processes will require smaller tolerances than currently obtained to achieve the desired quality and reliability. Designers of components and machines will need a better understanding of the potential error sources and the way they will influence the final component. This course will build the foundations for dimensional metrology and error analysis to give the student the ability to predict the potential precision - that is, the accuracy and repeatability - of a new machine design. The course will:
  - Describe the foundations of mechanical metrology
  - Discuss the instruments currently used for precision measurement, their operating principles, advantages and limitations
  - To study how to set up the measurements and how to use the results to evaluate the performance of the machine
  - Develop an understanding of techniques for error analysis and performance prediction

SECTION - A

UNIT-I: i) **Standards of measurements:** principles of measurements, line and end standards, slip gauges, end bars, wave-length standards, classification of standards.

ii) Interchangeability. Universal and local interchangeability, selective assembly, concept of limits, tolerance and allowances, types of fits and gauges. B.S. system and Indian standard specification for limits and fits, design of plain limit gauges and their manufacture.

ii) Screw thread limit, fits, design of screw thread limit gauges. (8)

UNIT-II: i) **Measuring instruments:** 1. Linear measurements - length measuring instruments based on Vernier principle, Micrometers, Dial gauges.

ii) **Comparators:** various comparators such as mechanical, electrical, and electronic optical and pneumatic

comparators, their principle of operation and application.

iii) **Angular measurements:** Vernier and Universal Bevel protractor, Sine bar, levels, clinometers, optical dividing head. Angular slip gauges, taper gauges, autocollimeter.

iv) **Optical instruments:** Projector, tool makers' microscope, interferometers. (8)

UNIT-III: Measurements :

i) **Screw thread measurement:** measurement of elements of screw threads, major & minor pitch and effective diameters, errors in screw thread elements and their effects, external and internal screw threads.

ii) **Gear measurements:** inspection of gears for tooth thickness, measurement of tooth profile, pitch measurement, alignment error, master gear, Parkinson gear tester.

iii) **Surface roughness:** surface texture measurements and gauging, surface roughness in various manufacturing process.

iv) **Geometrical features:** flatness, squreness, roundness, cylindricity.

v) **Automated inspection:** in process gauging and principle of co-ordinate measuring machine. (7)

SECTION – B

UNIT-IV: i) **Basic concepts of quality and quality control**: fitness, for use, quality characteristics, parameters of fitness for use quality function, quality control, quality assurance.

ii) **Quality policies and objectives:** the need for quality policies, formulation of quality policies, quality objectives for break through and control.

iii) **Quality costs:** phases in quality cost program, discovering the optimum quality cost.

iv) Process acceptance is product acceptance, advisory Vs. mandatory process, quality mindedness, quality control circles, vendor inspection, vendor rating, process capability study. (8)

UNIT-V: **Statistical quality control :** importance of statistical methods in quality control, basic philosophy and principles of sub grouping, meaning of statistical control, variables and attributes, measurements and inspection, different types of control charts (X-R, MP, P and C charts) (7)

UNIT-VI: Acceptances sampling : sampling inspection, viz hundred percent inspection, basic concepts of sampling inspection, operating characteristics curve, conflicting interests of consumer and producer's producers and consumer's risk, AQL, LTPO, AOQL, Single and double sampling plans, acceptance/ rejections, acceptance rectification plans. (7)

TEXT BOOKS:

1) Engineering Metrology : R.K.Jain
2) Engineering Metrology: I.C.Gupta
3) Statistical Quality Control : Gupta R.C.

REFERENCE BOOKS:

1) Quality Control Hand Book : J.M.Juran
2) Statistical Quality Control : Grant
3) Metrology and Measuring Instruments : M.R.Taher.
4) Engineering Metrology : K.W.B.Sharp,
5) Statistical Quality Control : Grant E.L., R.S.Leavenwogth.

6PE03 MACHINE TOOL DESIGN

Lecture : 04 Hrs/ w — **Internal Assessments:** 20
Tutorial : 01 Hrs/ w — **University Exam:** 80
Credits : 05 — **Theory Paper (Hrs.) :** 03

Course Objectives:

- The main objective of this course is to offer the student the basics of Machine Tool Design.
- To make the students understand the concepts & broad principles of contents of the course.
- Sensitizes the students of the importance of course in real life environment.
- Study of procedure to design various machine tool members under different loading.

SECTION-A

UNIT-I: Design of spur, helical, bevel and worm gear drives, design of belt and chain drives. (8)

UNIT-II: Design of clutches and brakes, journal bearing and lubrication, selection of ball and roller bearings. (8)

UNIT-III: General classification, general requirements of m/c tools, aim of speed and feed rate regulation, classification of speed and feed boxes, step less regulation of speed and feed rates. (8)

SECTION-B

UNIT-IV : Design of speed and feed boxes :- stepped regulation of speed, break up of speed step, selection of best possible structure diagram, speed chart, design of feed box, determining the numbers of teeth of gears. (8)

UNIT-V: Design of m/c tool structure :- Functions, and their requirements design criteria, materials used, profiles used, basic design procedure, guide ways, slide ways and antifriction ways, shapes and material used, method of adjusting clearance in slide ways, protecting devices for slide ways. Design of spindles. (10)

UNIT-VI: Regulation of speed in electrical control circuits, electrical circuits diagram for starting and stopping the motor of a m/c tool, electrical brakes, electromagnetic clutch, ferromagnetic power clutch, thermal relay in m/c tools, electrical automation in m/c tools. Acceptance test of lathe and drilling. (6)

TEXT BOOKS :

1. MACHINE TOOL DESIGN, N. K. Mehta, Tata McGraw Hill, ISBN 0-07-451775-9.
2. DESIGN OF MACHINE TOOL, D. K Pal, S. K. Basu, 4th Edition. Oxford IBH 2005, ISBN 81-204-0968

REFERENCE BOOKS:

1. PRINCIPLES OF MACHINE TOOL, Bhattacharya and S. G. Sen., New central book agency Calcutta, ISBN 81- 7381-1555.
2. MACHINE TOOL, N. S. Acherkan, Vol. I, II, III and IV, MIR publications.
3. DESIGN PRINCIPLES OF METAL CUTTING MACHINE TOOLS, F. Koenigsberger, The Macmillan Company New York 1964.
4. MACHINE TOOL DESIGN HANDBOOK, C.M.T.I. Bangalore, (TMH)
5. DESIGN DATA HANDBOOK, K. Mahadevan and K. Balveera Reddy, C.B.S. Publishers & Distributors
6. Product Design and Manufacturing, (3/e), A. K. Chitale and R. C. Gupta, Prentice- Hall of India Pvt. Ltd.

6PE04 WORK STUDY

Lecture : 04 Hrs/ w — **Internal Assessments:** 20
Tutorial : _____ — **University Exam:** 80
Credits : 04 — **Theory Paper (Hrs.) :** 03

Course Objectives:

- The Work-Study Program encourages community service work and work related to each student's course of study. It develops scientific methods for doing work.

- Establishes goals for productivity and systems of reward for meeting goals. Also trains the personnel in how to use the methods and thereby meet the goals.

SECTION-A

UNIT-I : Work Study: Definition, objectives and scope of work study, Contribution of Taylor and Gilbreth, Work study and Productivity. Problems in increasing productivity through work study. The human factor in the application of work study. Classification of work study. (8)

UNIT-II: Method study: Definition, objectives and basic procedure of method study, symbols in charting, different recording techniques, analysis and critical examinations of operation and development of improved method. Principals of motion Economy, Introduction to memomotion and micromotion study. (8)

UNIT-III: Charts and Diagrams: Study of Operation process chart, Flow process chart, Multiple activity charts, Two handed charts. SIMO chart, Flow and string diagram cycle graph, crono cycle graph, (8)

SECTION-B

UNIT-IV: Work Measurement: Definition of Time study, basic procedure and equipments of time study. Breaking of an operation into elements. Allowances and their applications, Calculation of standard time. (8)

UNIT-V: Work sampling :- Concept, steps, advantages, applications and limitations of work sampling, sampling errors and confidence level, Introduction to standard data and synthetic time study devices. Introduction to Job Evaluation system and its necessity; Job Analysis, Description and Evaluation. Evaluation Systems like Factor Comparison, Point System, Merit rating. (8)

UNIT-VI: Application of Work Study: Introduction of work study into organization, its application in manufacturing and service sector, training of personnel in work study, Wage incentives plans, Case studies and analysis. (8)

TEXT BOOKS :

1. ILO, "INTRODUCTION TO WORK-STUDY", Universal Publishing Company. ISBN 81-8502700-4.
2. "WORK STUDY" , By O. P. Khanna, Dhanpat Rai Publications, New Delhi.
3. Work Study And Ergonomics by S.K. Sharma, Savita Sharma, 1 st Ed. , S.K. Kataria & Sons , 4760-61/23, Ansari Road, Daryaganj, New Delhi-110002 (India) ISBN 9788188458349

REFERENCE BOOKS:

1. Yoga M., JOB EVALUATION, National Productivity Council; New Delhi, India; 1971; First Edition
2. Zandin Kjell.B, "MOST WORK MEASUREMENT SYSTEMS". Publisher: M. Dekker ISBN-10: 0-8247- 6899-X, ISBN-13: 9780824768997
3. Maynard H. B., "INDUSTRIAL ENGINEERING HANDBOOK", 3rd edition, McGraw Hill Book Company. ISBN 0-07-041084-4
4. Text Book of Work Study And Ergonomics, By Suresh Dalela and Saurabh Dalela

6FEPE05 FREE ELECTIVE - II
(01) INDUSTRIAL AUTOMATION

Lecture : 03 Hrs/ w	**Internal Assessments:** 20
Tutorial : _____	**University Exam:** 80
Credits : 03	**Theory Paper (Hrs.) :** 03

Course Objectives:

- To understand &implementation of Basic & Application sensor for simple factory Automation
- The course is aimed to study the concepts and implementation techniques of Industrial Electronics and Industrial Automation.
- It provides the understanding of PLC hardware and programming techniques.
- Furthermore, it provides the basic understanding of Hydraulic and Pneumatic systems
- To understand basic skills useful in automated machines and equipment and describe the terms and phrases associated with industrial automation.

SECTION – A

UNIT- I: Automation of assembly lines : Concept of automation, mechanization and automation, Concept of automation in industry, mechanization and automation, classification, balancing of assembly line using available algorithms. Transfer line-monitoring system (TLMS) using Line Status, Line efficiency. Buffer stock Simulation in assembly line. (7)

UNIT- II: Automation using hydraulic systems: Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. Selection of hydraulic fluid, practical case studied on hydraulic circuit design and performance analysis. Servo valves, electro hydraulic valves, proportional valves and their applications. (7)

UNIT- III: Automation using pneumatic systems : Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods – step counter method - compound circuit design - combination circuit design. Pneumatic equipments - selection of components – design calculations -application - fault finding – hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits. (8)

SECTION – B

UNIT- IV : Automation using electronic systems : Introduction, various sensors, transducers, signal processing, servo systems, programming of microprocessors using 8085 instruction, programmable logic controllers. (7)

UNIT- V: Automated work piece handling: Working principles and techniques, job orienting and feeding devices. Transfer mechanisms automated feed cut of components, performance analysis. Uses of various types of handling systems including AGV and its various guiding technologies. (8)

UNIT- VI: Introduction to robot technology: Robot physical configuration and basic robot motions, Types of manipulators- constructional features, servo and non servo manipulators. Feedback systems and sensorsencoders and other feedback systems, vision, ranging systems, tactile sensors. Programming languages description of VAL and other languages. Artificial intelligence-legged locomotion and expert systems. (8)

TEXT BOOKS:

1. Groover, M.P., CAD/CAM- Prentice Hall
2. Yoram Koren, Robotics for Engineers- McGraw Hill 1992
3. Paul, R.P., Robot Manipulators- MIT Press 1993

REFERENCE BOOKS:

1. Andrew Parr, “ Hydraulic and Pneumatic “, (HB), Jaico Publishing House,
2. Bolton. W. “ Pneumatic and Hydraulic Systems “, Butterworth - Heineman,

6FEPE05 FREE ELECTIVE - II
(02) ENTREPRENEURSHIP DEVELOPMENT AND ENGINEERING ECONOMICS

Lecture : 03 Hrs/ w	**Internal Assessments:** 20
Tutorial : _____	**University Exam:** 80
Credits : 03	**Theory Paper (Hrs.) :** 03

Course Objectives:

- Engineering Economics gives the students an overview of the economics methods employed in effective engineering decisions as related to the designing, planning and implementation of successful projects. It emphasizes the practical benefits of the applications of such tools as Time Value of Money calculations, Depreciation, Replacement Analysis, Benefit to Cost Ratios, Break-even Analysis, and Life Cycle Cost.
- Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/ vocational stream students to start their own small scale business/enterprise.

SECTION – A

UNIT I : Industrial Economics : Basic Concepts, Demand Analysis, Types of Demand, Determinants of Demand, Methods of Demand Forecasting, Supply, Law of Diminishing Marginal Utility, Elasticity of Demand. (7)

UNIT II : Factors Of Production, Production Function, firm and Industry, Laws of Return, Cost Concepts, Fixed Variable, Average, Marginal And Total cost, Break Even Analysis, Depreciation Cost, Taxation System, Types of Taxes. (8)

UNIT III: Optimum size of Unit, Optimum Firm, Industrial Combinations, Causes for the Growth of combinations. Forms of combination In India, Various Competitive Situations, Perfect, Monopoly, Monopolistic, Oligopoly. Price Determination Under These Situations. Impact of Globalization on Indian Economy. (7)

SECTION – B

UNIT IV: Concept of Entrepreneurship, Definition, competencies Of Entrepreneurs, Entrepreneurial Functions, Achievement, Motivation, Types of Enterprises. Policies Governing Small Scale Industries, Procedure to Set Up Small Scale Industrial Unit, Advantages and Limitations Of SSI. (8)

UNIT V: Market Survey And Factors Governing Product Selection. Project Report Preparation, Technical, Financial and Marketing Analysis of the Project. Factors Governing the Selection of Site, Plant And Machinery. Financial and Ratio Analysis. (7)

UNIT VI: Role Of Consultancy organizations, Role of District Industries Center, State Ind. Develo0pment Corporations, Banks And Financial Institutions, Latest SSI Intensive Schemes (To be confirmed From DIC Time to Time) Determination Of Working Capital Requirement, Industrial Overheads, Determination Of product Sales Cost. (8)

TEXT BOOKS :

1. D.Salvatore , “Managerial Economics in a global economy” Tata McGraw Hill
2. Reckie and Crooke., “ Managerial Economics” Prentice Hall; 4 edition.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi

REFERENCES BOOKS ::

1. Khan M.Y., Jain P.K , “Management Accounting”, Tata Mc Graw Hill, 1995.
2. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
3. Entrepreneurship: New Venture Creation - David H. Holt
4. Handbook of Small Scale Industry by PM Bhandari

6PE06 TOOL ENGINEERING – II – Lab.

Practical : 02 Hrs/ w — **Practical Term Work:** 25
Tutorial : _____ — **Practical / Oral Exam:** 25
Credits : 01

Objectives:

- To meet the requirements of industry in the fields of jigs, fixtures and dies.

- To train students in designing different tools drill jigs, turning fixture, milling fixture and forming dies.
- Student should have the knowledge of metal forming process.

TERM WORK:
At least eight designs based on above syllabus as given below:

1) Design and drawing of drilling / reaming jigs. - **3 sheets**
2) Design and drawing of milling fixtures. - **3 sheets**
3) Design of drawing of press tools - **3 sheets**
   *(For all above 3 designs at least **one printout of each design** is showing manufacturing drawing with tolerances, material specification and heat treatment using well known commercial available drafting package.)*
4) Design of drawing of forging dies - **1 sheet**
5) Problem on roll pass design - **1 sheet**
6) Design and drawing of one progressive die. - **1 sheet**
7) Design and drawing of one drawing die. - **1 sheet**
   (Out of above 4 designs take printout of any one design using well known commercial available drafting package.)
8) 3D model of various elements of jigs and fixtures using well known commercial available drafting package.
   Above mentioned design work should be done by a batch of not more than ten students for each component.
   A Journal / Report on experiments conducted shall be submitted by each student. Practical examination shall be vivavoce based on above practical and the syllabus of the course, taken jointly by internal & external examiner.

6PE07 METROLOGY AND QUALITY CONTROL - Lab.

Practical : 02 Hrs/ w — **Practical Term Work:** 25
Tutorial : _____ — **Practical / Oral Exam:** 25
Credits : 01
Objectives:

- To develop hands-on-skills on tools and techniques of measurements for industrial Metrology and Quality Control.
- Making the students well acquainted with basic concept to quality and it’s corelational criteria’s to implement the concept of quality.
- Students should be able to apply the principles of Metrology and Quality Control system.
- To provide the students with a sound basic background in a vast field of Metrology and Quality Control and understand its practical applications.
- Develop an understanding of techniques for error analysis and performance prediction

TERM WORK:

Term work shall consist of eight experiments based on the following:-

1) Design and drawing of at least two types of limit gauges.
2) Problem solving and sketching figures for Selection of slip gauges
3) Problem solving and sketching figures for angle gauges
4) Study of comparators
5) Study of angular measurement
6) Study of screw thread measurement
7) Measurement of Gear tooth thickness using Gear tooth Vernier caliper and Span Micrometer
8) Study of flatness and squareness measurement
9) Measurement of angle by Sine bar / Sine center.
10) Study and Experiment on Profile Projector.
11) Measurement of Screw thread parameters using Floating Carriage Micrometer.
12) Calibration of instrument using Calibration setup.

6PE08 MACHINE TOOL DESIGN – Lab.

Practical : 02 Hrs/ w **Practical Term Work:** 25
Tutorial : _____ **Practical / Oral Exam:** 25
Credits : 01

Objectives:

- To have develop hands on skills in the subject
- Develop the practical aspects of the theory knowledge
- Application of the theory with Understanding of fundamentals of the subject and be in a position to explain the procedure of the experiments.

TERM WORK:

Practical Minimum 8 out of following:

1. Design and working drawing of Speed Gear Box
2. Design and working drawing of Feed Gear Box
3. Design of clutches or breaks drive.
4. Design of belt or chain drive.
5. Design of electrical circuits.
6. Inspection and acceptance test.
7. Study of Step-less Drives
8. Design of Base
9. Design of Bed
10. Design of Column
11. Design of Slide ways
12. Design of Spindle
13. Power Screw Design (Sliding & Rolling friction)
14. Design of Guide ways

A journal should be prepared and submitted on above term work. The practical examination shall based upon the term work and viva examination.

6PE09 MINOR PROJECT (MACHINE SHOP PRACTICE)

Practical : 03 Hrs/ w **Practical Term Work:** 25
Tutorial : _____ **Practical / Oral Exam:** 25
Credits : 03

Objectives:

- Applying tools and methodologies of a field of practice in a Machine Shop Project.
- Applying skills and academic knowledge in a workplace.
- Application of the theory with Understanding of fundamentals of the subject and be in a position to explain the procedure of the experiments.

TERM WORK:

Term work shall consist of minimum **02** composite jobs involving operations on the **Lathe, Shaping, Milling, Drilling and Slotting Machine.**

Each student shall submit details of operations, process analysis along with flow process charts for the jobs prepared and time estimation of each job in the form of journal.

PRACTICAL EXAMINATION:

Practical examination shall consist of assessment of above term work and oral based on above term work.

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SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
ELECTRONICS & TELECOMMUNICATION ENGINEERING
SEMESTER PATTERN (C. G. S.)
FIFTH SEMESTER

5XT1/ 5XN 1 ELECTRONIC DEVICES AND CIRCUITS-II
SECTION-A

Unit I : Linear wave shaping using RC and RL circuits, analysis and calculations of RC low pass and high pass filters, analysis of clipping and clamping circuits using diodes and switching transistors.

Unit II : Switching characteristics of semiconductor devices : Diode as switch, transistor as a switch, characteristics and analysis, FET as a switch, characteristics, JFET, CMOS, switching speed of devices : Schottky diode and transistor, Logic gates.

Unit III : Collector coupled bistable, monostable and astable multivibrators, Time base generators & Sweep Generators. Boolean Algebra, Number systems, Gray codes, Arithmetic operations using Two's compliments.

SECTION-B

Unit IV : Study and analysis of Digital Logic Families : RTL, DTL, HTL, TTL, ECL, IIL, CMOS, and their characteristics, tri-state logic,5400/7400 TTL series.

Unit V : Flip-flops : R-S, J-K, Master slave J-K, D-type, T-type; registers and counters, adders and subtractors using logic gates, D/A converters and types: Weighted resister, R-2R ladder. A/D converters and Types: Ramp, Dual slope, Successive approximation.

Unit VI : Types of semiconductor memories, sequential memories, 2 and 4 phase ratioless shift registers, static shift registers, implementation of ROM (ROM, PROM, EPROM, EEPROM) BJT RAM cell, MOS-RAM, CCD memories.

BOOKS RECOMMENDED :

1) Jacob Millman & Herbert Taub : "Pulse Digital & Switching waveforms", McGraw Hill International Book Co.
2) Taub H. and Schillings D.L., London, : "Digital Integrated Electronics", McGraw Hill Company.
3) R. P. Jain : "Modern Digital Electronics", Tata McGraw Hill, New Delhi 1998.

4) Malvino A.P. & Leach D.P. : "Digital Principles &Applications", TMH Publishing Co., New Delhi (3rd Edition).

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5XT2 / 5XN2 POWER ELECTRONICS
SECTION-A

Unit I : SCR, Triac, LASCR, Diac-construction, characteristics, two transistor analogy for turning ON of a SCR, turn ON mechanism, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuits. Introduction to GTO, power transistor, power MOSFET, IGBT - their construction & characteristics.

Unit II: Series parallel operation of SCRs, static & dynamic equalizing ckts., equalisation of current in parallel connected SCRs, string efficiency, derating factor, Protection of SCRs against di/dt, dv/dt, radio freq., interference, over voltage, over current.

Unit III: Principle of phase control, half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of free wheeling diode, single phase dual converters. Three phase half controlled bridge and fully controlled bridge rectifier.

SECTION-B

Unit IV: Classification of ckt. for forced commutation, series inverter, improved series inverter, parallel inverter, output voltage and waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorised bridge inverter, current source inverter, harmonics reduction techniques.

Unit V: Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper and AC chopper. Basic principle of cycloconverter, single phase to single phase cycloconverter.

Unit VI: Speed control of DC series motors using chopper, speed control of DC shunt motor using phase controlled rectifiers, Static ckt. breaker, UPS, fan speed regulator, principle of soft start ckts, electronic ballast.

TEXT BOOKS:

1) M. Ramamoorthy, Thyristor and their application.

2) M. H. Rashid - Power Electronics Circuits, Devices and Application, Pearson Edu.
3) SCR Manual GE.

REFERENCE BOOKS :

1) Joseph Vithayathil, "Power Electronics: Principles and Applications", McGraw-Hill
2) Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics: Converters, Applications, and Design", Wiley
3) K. Hari Babu – Power Electronics, Scitech Pub..
4) Devdatta Y. Shingare, A Text book of Industrial & power electronics, Electrotech Pub. Satara.
5) J. S. Katre, Power Electronics, Tech-max Pub. Pune.

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5XT3 / 5XN3 CONTROL SYSTEM ENGINEERING

SECTION-A

Unit I : Basic definition; closed and open loop systems; transfer function, block diagrams, derivation of transfer functions of physical systems, signal flow graphs, basic control action.

Unit II : Time Response Analysis: Typical test inputs, , Impulse response function, Transient Domain specifications, Analysis of first, second & higher order systems, Steady state analysis: steady state error and error constants, Dynamic error coefficients.

Unit III: **1.** Stability Analysis: stability of control system, Routh Hurwitz's stability criterion,

2. Roots Locus: Introduction to Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant closed loop pole pair, Root contour plots, effect of addition of zeros & poles.

SECTION-B

Unit IV : Introduction of frequency response, Bode plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.

Unit V : State Space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations, concepts of controllability and observability.

Unit VI : **Sample Data Control Systems :** Representation of sampled data (Discrete) systems, review of Z-transforms, Sampler and hold ckt., Zero order hold, sampling theorem, Z-transform analysis of sampled data control systems (open & closed loop systems), Z transform of systems. Solution of difference equation by Z-transform methods. Response of discrete systems. Pulse Transform functions of open loop, closed loop systems with different sampler locations. Digital controller & its transfer functions, Stability analysis of discrete time system using bilinear transformation.

TEXT BOOK :

1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed. New Age International.
2. K. Ogata : Modern Control Engineering, Fourth Edition(PHI)

REFERENCE BOOKS:

1) Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11^{th} Ed., Pearson Education.
2) M. Gopal : Digital Control Systems Principles & Design (TMH)
3) Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
4) Bhattarcharya: Control System Engineering, 2^{nd} Edition (Pearson Education).

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5XT4 / 5XN4 COMMUNICATION ENGINEERING-II

SECTION-A

Unit I : **AM Transmitters :** Modulation, need of modulation, AM Modulation, Frequency spectrum, Principles of DSB-FC, DSBSC, SSB-SC modulation and their comparison, Details of DSBFC Transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC Transmitter, Generation of SSB-SC by filter method, phase-shift method & third method (weavers).

Unit II : **AM Receivers :** TRF receiver, Super heterodyne receiver, Details of each block such as RF amplifier, mixer oscillator, IF amplifier, Diode detector, Audio Amplifier. Need and type of AGC, selectivity sensitivity, fidelity Image rejection ration, communication receiver, SNR of DSB-FC, DSB-SC & SSB-SC

Unit III : **FM Transmitters :** FM Modulation, Frequency Spectrum, Circuits & Analysis for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow Band and Wide Band FM, their comparison, pre-emphasis and De- emphasis. Stereo FM Transmitter.

SECTION-B

Unit IV : FM Receivers : Details of FM receiver blocks such as R.F. amplifier, local oscillator, IF amplifier, Mixer, Audio Amplifier, AGC, Limiter, FM Discriminator, Single Slope and Balanced slope detector, Analysis of Foster Seeley and ratio detectors, Stereo FM receiver, Noise in FM Reception, FM threshold effect.

Unit V: Pulse Modulation Techniques: The sampling theorem, Sampling of Band-Pass Signal, Linear and Non linear quantization, Aliasing effect, Aperture effect, Reconstruction filter, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Time Modulation, PCM, DM, ADM

Unit VI : Telephone Switching Techniques : Introduction to Switching System, Pulse dialing, Touch tone dial telephone, Space Division Switching SPC, Centralized and Distributed SPC, Time Division Switching : Basic Time Division space switching, Time Division time switching, Time multiplexed space switching, Time Multiplexed time switching, EPABX.

Text Books:-

(1) Taub and Schilling D.L. : Principles of Communication Systems, McGraw Hill Co, Tokyo, 1994 (II Ed.)

(2) Kennedy G. : “Electronic Communication System” Tata Mc-Graw Hill Co., New Delhi (Third Edition)

(3) T. Vishwanathan : “ Telecommunication Switching systems and Networks”, PHI learning Private Ltd., 2009

Reference Books :

(1) Wayne Tomasi, “Electronic Communication Systems”, Pearson Education, third edition

(2) Simon Haykin : “Communication System, John Wiley and Sons Ltd., New York, (Third Edition), 1994

(3) B. P. Lathi : “ Modern Digital and Analog Communication systems” 4th Edition Oxford University Press.

(4) Hari Bhat: “Analog communication”, 2nd Edition Pearson India, 2010

(5) S. Kundu: “ Analog and Digital communication”, Pearson India 2010

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FREE ELECTIVE- I
5FEXT5 / 5FEXN5 (1) CONSUMER ELECTRONICS
SECTION-A

Unit I : Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying Systems, Equalizers and Mixers, Electronic Music Synthesizers, Commercial Sound, Theater Sound System **(8 Lectures)**

Unit II : Video Systems and Displays: Colour TV standards and systems, TFT, Plasma, HDTV, Digital TV, Remote Controls, Video Telephone and Video Conferencing **(8 Lectures)**

Unit III : Domestic Appliances: Washing machines, Microwave ovens, Air- conditioners and Refrigerators, Computers Office Systems: FAX, Xerox, Telephone Switching System, Mobile Radio System. **(8 Lectures)**

SECTION-B

Unit IV : Recording and Reproduction Systems: Disc recording and reproduction, Magnetic recording and reproduction, Video disc recording and play back, Distortion and Noise reduction in Audio and Video System **(8 Lectures)**

Unit V : Power Supplies and other systems: SMPS, UPS and Preventive Maintenance, Set Top Boxes, Remote controls, Bar codes, ATM, Dish washers **(8 Lectures)**

Unit VI : Calculators: Structure, internal organization, servicing; In-Car-Computers: electronic ignition, electronic ignition lock system, Antilock Braking System (ABS), Electronically controlled Suspension (ECS), Instrument panel displays, ultrasonic car safety belt system, Air Bag System, Vehicle proximity detection system, car navigation system **(8 Lectures)**

Text Book:1. Consumer Electronics S P Bali Pearson Ed 2005

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FREE ELECTIVE- I
5FEXT5 /5FEXN5 (2) FIBER OPTICS
SECTION-A

Unit -I : Light Ray Theory

Propagation of light in different media : propagation of light in an optical fiber, Basic structure and optical path of an optical fiber, Acceptance angle and acceptance cone, Numerical aperture(NA) (General), Modes of propagation, Meridional and skew rays, Number of modes and cut-off parameters of fibers. **8 Lectures**

Unit - II: Losses and Dispersion in Optical Fiber

Fiber Losses : Attenuation in optic fibers, Materials losses, Rayleigh scattering losses, Absorption loss, Leaky modes, Bending losses, Radiation losses.

Dispersion in optical fiber: Electrical Vs. optical bandwidth. Bandwidth-length product, Intermodal dispersion, Mixing modes, Material chromatic dispersion. **(8 Lectures)**

Unit-III: Light Sources and Detectors for Optical Fiber (8 Lectures)

Light Sources : Introduction, LED (Light Emitting Diode), Processes involved, structure material and output characteristics of LED, Fiber LED coupling, Bandwidth, Spectral emission of LEDs, LASERS : Operation types, Spatial emission pattern, Current Vs. output characteristics.

Detectors : Introduction, Characteristics of photo detectors (General), Photoemissive type, Photoconductive and photo voltaic devices, PN junction type, PIN photo diode, Avalanche photo diode (APD).

SECTION-B

Unit -IV: Fiber optic Communication systems and Modulation

Fiber Communication systems : Transmitter for fiber optic communication, High performance transmitter circuit LED – Analog transmitter, LASER transmitter, Digital laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Fiber optic receiver, Fiber based modems : Transceiver.

Modulation : LED analog modulation, Digital modulation, Laser modulation, Pulse code modulation (PCM), Intensity modulation (IM). **(8 Lectures)**

Unit -V: Optical Fiber Communication application

Optical fiber communication systems : Introduction, Important applications of integrated optic fiber communication technology, Long haul communication, Coherent optical fiber Commun-ication, Principle of coherent detection. **(8 Lectures)**

Unit -VI : Measurements on Optical Fibers

Introduction, Measurements of numerical aperture (NA),Measurements of Fiber- attenuation, Optical time Domain Reflectometry (OTDR), Measure-ments of dispersion losses, Measurements of refractive index, Cut-off wavelength measurement, Measurements of Mode Field Diameter (MFD), **(8 Lectures)**

Text Books:

1. Optical Fiber Communications : Principles and Practices- John M. Senior (PHI)
2. Optical Fiber and Optical Fiber Communication Systems S. K. Sarkar (S. Chand and Comp.

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5XT6 / 5XN 6 COMMUNICATION SKILLS

Unit I : Comprehension over an unseen passage. Comprehension – A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Comprehension - B - Structure study :-Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization.

Unit II : Theoretical background - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content. Non-verbal communication, types of graphics and pictorial devices.

Unit III : Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. methodology of conduction of meetings, seminars, symposia, conference and workshop.

BOOKS RECOMMENDED:

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.

2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.

3) Raman Sharma "Technical Communication", Oxford University Press..

4) F. Frank Candlin : General English for Technical Students, University of London Press Ltd.

5XT7: Electronic Devices & Circuits-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT1(Electronic Devices & Circuits-II)

5XT8: Power Electronics Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT2(Power Electronics)

5XT9: Communication Engineering-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT4 (Communication Engineering-II)

5XT10: Communication Skills Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XT6 (Communication Skills)

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6XT1/ 6XN1 DIGITAL INTEGRATED CIRCUITS

SECTION-A

Unit I : Combinational Logic Design: Function of binary variables, Boolean Algebraic Theorems, Standard form of logic functions, K-Map up to 5 variables, Quine McCluskey Method, Don't Care Conditions and its effects, Synthesis using AND-OR Gates **(8 periods)**

Unit II: Combinational Logic Design using 74/54 MSI chip series concerning to MUX, DEMUX, Decoders, Encoders, Comparators, Code converters, Priority Encoders, Parity Generator/Checker and BCD to Seven Segment Decoders **(8 periods)**

Unit III: Combinational Logic Design using ROM array, PLA, PAL, preliminary design concepts using FPGAs, N-bit binary adder using 7480, Look-ahead carry adder construction **(8 periods)**

SECTION-B

Unit IV: Design of counters and sequential networks. Analysis of clocked sequential networks, general models of sequential machines, equivalence and minimization networks, deviation of state graphs and tables, reduction of state assignments, SM charts **(8 periods)**

Unit V: Analysis of asynchronous sequential networks, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, asynchronous sequential network design **(8 periods)**

Unit VI: Fault detection and location in combinational circuits. Paths sensitizing method, equivalent – normal – Form method (ENF), two level fault detection, fault detection and location in sequential circuit using circuit test approach **(8 periods)**

Text Books:

1. Charles H. Roth, "Fundamentals of Logic Design", 4th Edition, Jaico Publication
2. Lee S. C., "Digital Circuit and Logic Design", PHI
3. Jain R. P. "Modern Digital Electronic Circuits and Systems", TMH

Reference Books:

1. Digital IC Reference data manuals
2. Texas Instruments Inc. Design with TTL ICs
3. Morris Mano, "Digital Electronics: Circuits and Systems", PHI
4. Parag K. Lala, "Fault tolerance and fault testable hardware design, B. S. Publications, Hyderabad

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6XT2 /6XN2 LINEAR INTEGRATED CIRCUITS

SECTION-A

Unit I: Operational Amplifier, block diagram of op-amp, Differential amplifier: gain expressions using h - parameters, constant current source, level shifting, transfer- characteristics, frequency response, frequency compensation methods, study of ICuA741, measurement of parameters of op-amp and offset nulling and their importance.

Unit II: Linear Applications of Op-Amp: Inverting and non inverting amplifiers, voltage followers (AC & DC), integrator, differentiator, differential amplifier, instrumentation amplifiers, precision rectifiers, RMS to DC converter, voltage to current converter, sinusoidal RC oscillators, constant voltage sources, frequency to voltage and voltage to frequency converter.

Unit III: Non Linear Applications of Op-Amp and Filter Circuits: Clipping and clamping circuits, comparator, zero crossing detector, Schmitt trigger, peak detector, astable, monostable and bistable multivibrator, voltage sweep generator.
Active filters : Butterworth filters using op-amp. Log and Antilog amplifiers.

SECTION-B

Unit IV: Voltage Regulator: Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78**, 79**, and LM 317.

Unit V:1. Timers : Block schematic of IC 555, application of timer 555 as astable, monostable and bistable multivibrators, frequency divider, pulse stretcher, sawtooth generator, free running ramp generator, FSK generator.

Unit V: 2.Sample & hold circuit.

Unit VI:1. PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its applications as AM detector, FM detector and frequency translator.

Unit VI: 2. Introduction to Audio Function Generator IC 8038.

Text Books :

1) Gayakwad R.A. : OP-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (Second Edition), 1980.
2) Robert F. Coughlin, Frederick F. Driscoll: Operational Amplifier and Linear Integrated Circuits, Sixth Edition, PHI Pub.

Reference Books :

1) Tobey J.E. and Grame J.E. : Operational Amplifier Design and Applications, International Student Edition, 1983.
2) T.R. Ganesh Babu, B. Suseela: Linear Integrated Circuits, Third Edition, Scitech Pub.

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6XT3/6XN3 INTRODUCTION TO MICROPROCESSORS

SECTION-A

Unit I: 8085 : Architecture, Register Structure, Addressing modes, Instruction set of 8085, Timing diagrams.

Unit II : Assembly Language Programming of 8085, Introduction to assemblers, Simulators, Stack, Subroutine. Address space partitioning schemes : Memory mapped I/O and I/O mapped I/O, Address decoding techniques.

Unit III: Interrupt system of 8085, software and hardware interrupts, Data transfer schemes: Serial data transfer through SOD and SID, USART 8251 and its interfacing.

SECTION-B

Unit IV : Internal architecture, programming and interfacing of PPI 8255, Programmable interval Timer/ Counter 8254, Introduction to DMA data transfer , DMA Controller 8237 and its interfacing.

Unit V : 8086 : CPU architecture, internal operations, addressing modes, instruction formats, execution timing.

Unit VI : Instruction set of 8086, Assembly language programming (ELEMENTARY PROGRAMMING) Assembly Directives, Operators.

Text Books:

1) A. K. Ray and K. M. Bhurchandi: Advanced Microprocessors and Peripherals, Architecture Programming and Interfacing, TMH.
2) Gaonkar R.S. : Microprocessor Architecture Programming and Applications with the 8085, Penram International Pub. (Third Edition), 1997.
2) Gibson G.A., Liu Y.C. : Microcomputer system the 8086/8088 family, Prentice Hall India Pvt. Ltd.

Reference Books:

1) Hall D.V. : Microprocessor and Interfacing Programming and Hardware, McGraw Hill Co., New York, 1986.
2) Data sheet manuals by INTEL.

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6XT4 DIGITAL COMMUNICATION

SECTION-A

Unit 1:- Introduction to Digital Communication System
Functional Blocks of Digital Communication System; Source Encoder and Decoder; Channel Encoder and Decoder; Modulator and Demodulator
Line Coding:- Need for Line coding; Properties of Line Coding; Unipolar RZ and NRZ; Polar RZ and NRZ; Bipolar NRZ (AMI); Split Phase Manchester Coding; Polar Quaternary NRZ Coding; HDB3 Coding Scrambler and Unscrambler **(6)**

Unit 2:- Information Theory
Measure of Information; Entropy and Information Rate of Long Independent and Dependent Sequences; Markoff Statistical Model for Information Sources; Entropy and Information rate of Markoff Sources

Source Encoding: - Huffman Encoding; Shannon's Encoding Algorithm; Shannon-Fano Algorithm;
Discrete Communication Channel: - Noiseless Channel; Deterministic Channel; Binary Symmetric Channel; Rate of Information Transfer over Discrete Channel; Capacity of Discrete Memoryless Channel
Continuous Channel: Shannon Hartley Theorem for channel capacity; Signal to Noise Ratio –Bandwidth Tradeoff **(12)**

Unit 3:- Bandpass Modulation and Demodulation techniques
BPSK, BFSK, ASK and DPSK generation and reception; Signal space diagram, PSD and Bandwidth of BPSK and BFSK systems; QPSK and MSK Transmitter and Receiver; Signal space diagram, PSD and Bandwidth of QPSK and MSK; Probability of Error of ASK,BPSK and BFSK systems; Comparison of Digital modulation systems
Coherent Detection: - Integrate and Dump Filter (SNR and Probability of Error); Optimum Filter (Transfer function and Probability of Error); Matched Filter (Impulse response and Probability of Error) **(10)**

SECTION-B

Unit 4:- Base Band Transmission
Base Band Binary PAM systems, Inter Symbol Interference, Base Band Pulse Shaping and Nyquist Criterion; Eye Diagram
Correlative Coding: Duobinary Encoder with Pre-coder; Modified Duobinary Encoder; Modified Duobinary Encoder with Pre-coder
Equalization: Need for equalization; Transversal Equalizer (Problems Expected); Preset Equalizer; Adaptive Equalizer, Clock and Carrier Synchronization. **(8)**

Unit 5:- Error Control Coding
Introduction to Error Control Coding; Types of Errors; Methods of Controlling Errors;
Linear Block Codes: Matrix Description of Linear Block codes, Hamming Distance; Hamming Weight; Minimum Hamming Distance; Hamming Codes; Encoder for Linear Block code; Syndrome Decoding; Syndrome Decoder for (n,k) Linear Block Code; Error Detection and Correction capability of Linear Block Codes (Derivation expected)
Cyclic Codes: Properties of Cyclic Codes; Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes; Encoders for Cyclic Codes; Syndrome Decoding for Cyclic Codes

Convolution Codes: Time Domain Approach and Transform domain approach for convolution code generation; Code Tree and Code Trellis for Convolution code **(8)**

Unit 6:- Multiple Access Schemes and Spread Spectrum Communication
Multiple Access schemes: Time Division Multiple Access, Frequency Division Multiple Access; Code Division Multiple Access; Space Division Multiple Access
Spread Spectrum Systems: Notion of Spread Spectrum; PN Sequence Generation (Problems Expected); Direct Sequence Spread Spectrum (DSSS); Jamming Margin; Processing Gain; E_b/N_o Ratio; Frequency Hopped Spread Spectrum; Slow and Fast frequency Hopping. **(6)**

TEXT BOOKS:

1. Shanmugam K.S. :"Digital & Analog Communication Systems", John Wiley & Sons, New York, 1996.
2. Lathi B. P. :"Modern Digital and Communication Systems", Holt Rinchart and Winston Inc., New York, 1993.
3. Simon Haykin : "Digital Communication" , John Wiley and Sons, Pvt. Ltd., Singapore.

REFERENCE BOOKS :

1. Proakis J. K. :"Digital Communication", Mc-Graw Hill Book Co., London (Second Edition)
2. Taub, Herbert, Schilling D.L : "Principles of Communication Systems", Mc-Graw Hill International Book Co., Tokyo.
3. W.C.Y. Lee : "Mobile Cellular Telecommunications Systems", Mc-Graw Hill International Editions, 1990
4. Glover and Grant : "Digital Communication", Prentice Hall Publication.

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FREE ELECTIVE II
6FEXT5/ 6FEXN5 (1) INTRODUCTION TO WIRELESS TECHNOLOGY
SECTION-A

Unit I : **(8 Lectures)**
Introduction to networking: the Internet reference model, layering and protocols, OSI and other models, Network types, network media, network topologies, connectivity devices, evolution of networking, types and range of wireless communication, wireless technologies

Unit II : **(8 Lectures)**

Wireless LAN, satellite communication, wireless application protocol (WAP), antennas, narrow-band and spread-spectrum technologies, cellular telephony, propagation, frequencies and spectrum and personal communication system

Unit III : **(8 Lectures)**

Wireless Application Protocol model, WAP architecture component, Trends: technology and culture, 3G, wireless in local proximity, Bluetooth: design and principle of operation, transmitter characteristics, spurious emissions, baseband characteristics, physical channel, channel control, Bluetooth security, inter-operability requirements for blue-tooth as a WAP bearer

SECTION-B

Unit IV : **(8 Lectures)**

Cellular telephony, history of cellular telephony, design and principle of cellular operation, cellular telephony operation, analog cellular telephones, digital cellular telephones, digital networks, personal communication systems, the third generation, recent events in cellular telephony

Unit V : **(8 Lectures)**

Wireless LAN: introduction, benefits of WLANs, design and principle of operation, WLAN configuration, micro-cells and roaming, types of WLANs, WLAN customer consideration, wireless LAN standards, IEEE 802.11, 802.11b and 802.11a, selecting the WLAN, microwave LANs

Unit VI: **(8 Lectures)**

Communicating with a satellite, LEOs, MEOs, GEOs and HEOs systems, design and principle of operation of Global Positioning System (GPS); satellite, control and user segments, Differential GPS, geometric earth models and future of GPS

Text Book:

An Introduction to Wireless Technology by Garry S. Rogers and John Edwards, Pearson Education.

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FREE ELECTIVE II
6FEXT5/ 6FEXN5 (2) ELECTRONIC TEST INSTRUMENTS: ANALOG AND DIGITAL
SECTION-A

Unit I : **(8 Lectures)**

Analog meters, digital meters, dc voltmeter, ac voltmeters, RF probes, ammeters, ac ammeters, ohm-meters, 4-wire ohm measurements, multi-meters, meter range, other multi-meter functions: continuity indicators, diode tests, frequency counters, minimum, maximum, average read-outs, capacitance and temperature measurements, specifications

Unit II : **(8 Lectures)**

Floating and grounded outputs, sine wave sources, imperfections in sine wave sources,: frequency accuracy, frequency stability, amplitude accuracy, distortion, spurious responses, close-in-sidebands , Function Generators: Arbitrary waveform generators, arbitrary waveforms, AM and FM modulation, bursts, Frequency Shift Keying, Frequency sweep, sync output, phase locking, pulse generators, RF signal generators

Unit III : **(8 Lectures)**

Oscilloscopes: the concept of oscilloscope, digital scope block diagram, sample rate, real time and repetitive sampling, triggering, acquisition/sweep control, vertical amplifier, vertical resolution, ac and dc coupling, bandwidth limit, X-Y display mode, High impedance inputs, 50 ohm inputs, digital acquisition and display techniques, specifications of oscilloscopes, mixed signal oscilloscope, oscilloscope probes, probe compensation, active probes, differential measurements, high voltage probes, current probes

SECTION-B

Unit IV : **(8 Lectures)**

Oscilloscope measurements, basic waveform measurements, voltage gain measurements, phase measurements, frequency measurements, digital signal measurements, frequency response measurements, square wave tests, linearity measurements, curve tracer measurement techniques, diode I-V and resistor I-V characteristics, amplitude modulation measurements, power measurements, FFT measurements, basic time domain reflectometry

Unit V : **(8 Lectures)**

Spectrum and network analyzers: spectrum analyzer, bank-of-filters spectrum analyzers, FFT spectrum analyzers, wave-meters, resolution bandwidth, narrow-band and broadband measurements, swept spectrum analyzers, spectrum analyzer measurements, Network Analyzers, distortion analyzers, RF power measurements, RF power meter,

Unit VI : **(8 Lectures)**

Logic Analyzers: logic probes, oscilloscope logic measurements, logic analyzers, timing analyzers, glitch detect, state analyzers, data formats, state displays, timing displays, microprocessor measurements, trigger events and sequencing, microprocessor program flow, logic analyzer probing, combined scope and logic analyzer, PC-hosted logic analyzers

Text Book:

Electronic Test Instruments: Analog and Digital by Robert A. Witte, Second Edition, Pearson Education

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6XT6: Integrated Circuits Lab

Minimum 4 experiments uniformly distributed based on the syllabus of 6XT1(Digital Integrated Circuits) and 4 experiments uniformly distributed on the syllabus of 6XT2 (Linear Integrated Circuits)

6XT7: Introduction to Microprocessors Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XT3 (Introduction to Microprocessors)

6XT8: Digital Communication Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XT4 (Digital Communication)

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SYLLABUS PRESCRIBED FOR BACHELOR OF ENGINEERING ELECTRONICS ENGINEERING SEMESTER PATTERN (C. G. S.) FIFTH SEMESTER

5XN1 ELECTRONIC DEVICES AND CIRCUITS-II

SECTION-A

Unit I: Linear wave shaping using RC and RL circuits, analysis and calculations of RC low pass and high pass filters, analysis of clipping and clamping circuits using diodes and switching transistors.

Unit II : Switching characteristics of semiconductor devices : Diode as switch, transistor as a switch, characteristics and analysis, FET as a switch, characteristics, JFET, CMOS, switching speed of devices : Schottky diode and transistor, Logic gates.

Unit III : Collector coupled bistable, monostable and astable multivibrators, Time base generators & Sweep Generators. Boolean Algebra, Number systems, Gray codes, Arithmetic operations using Two's compliments.

SECTION-B

Unit IV : Study and analysis of Digital Logic Families : RTL, DTL, HTL, TTL, ECL, IIL, CMOS, and their characteristics, tri-state logic,5400/7400 TTL series.

Unit V : Flip-flops : R-S, J-K, Master slave J-K, D-type, T-type; registers and counters, adders and subtractors using logic gates, D/A converters and types: Weighted resister, R-2R ladder. A/D converters and Types: Ramp, Dual slope, Successive approximation.

Unit VI : Types of semiconductor memories, sequential memories, 2 and 4 phase ratioless shift registers, static shift registers, implementation of ROM (ROM, PROM, EPROM, EEPROM) BJT RAM cell, MOS-RAM, CCD memories.

BOOKS RECOMMENDED :

1) Jacob Millman & Herbert Taub : "Pulse Digital & Switching waveforms", McGraw Hill International Book Co.
2) Taub H. and Schillings D.L., London, : "Digital Integrated Electronics", McGraw Hill Company.
3) R. P. Jain : "Modern Digital Electronics", Tata McGraw Hill, New Delhi 1998.
4) Malvino A.P. & Leach D.P. : "Digital Principles &Applications", TMH Publishing Co., New Delhi (3rd Edition).

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5XN2 POWER ELECTRONICS
SECTION-A

Unit I : SCR, Triac, LASCR, Diac-construction, characteristics, two transistor analogy for turning ON of a SCR, turn ON mechanism, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuits. Introduction to GTO, power transistor, power MOSFET, IGBT - their construction & characteristics.

Unit II: Series parallel operation of SCRs, static & dynamic equalizing ckts., equalisation of current in parallel connected SCRs, string efficiency, derating factor, Protection of SCRs against di/dt, dv/dt, radio freq., interference, over voltage, over current.

Unit III: Principle of phase control, half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of free wheeling diode, single phase dual converters. Three phase half controlled bridge and fully controlled bridge rectifier.

SECTION-B

Unit IV: Classification of ckt. for forced commutation, series inverter, improved series inverter, parallel inverter, output voltage and waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorised bridge inverter, current source inverter, harmonics reduction techniques.

Unit V: Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper and AC chopper. Basic principle of cycloconverter, single phase to single phase cycloconverter.

Unit VI: Speed control of DC series motors using chopper, speed control of DC shunt motor using phase controlled rectifiers, Static ckt. breaker, UPS, fan speed regulator, principle of soft start ckts, electronic ballast.

TEXT BOOKS:

1) M. Ramamoorthy, Thyristor and their application.
2) M. H. Rashid - Power Electronics Circuits, Devices and Application, Pearson Edu.
3) SCR Manual GE.

REFERENCES :

1) Joseph Vithayathil, “Power Electronics: Principles and Applications”, McGraw-Hill

2) Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics: Converters, Applications, and Design”, Wiley
3) K. Hari Babu – Power Electronics, Scitech Pub..
4) Devdatta Y. Shingare, A Text book of Industrial & power electronics, Electrotech Pub. Satara.
5) J. S. Katre, Power Electronics, Tech-max Pub. Pune.

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5XN3 CONTROL SYSTEM ENGINEERING
SECTION-A

Unit I : Basic definition; closed and open loop systems; transfer function, block diagrams, derivation of transfer functions of physical systems, signal flow graphs, basic control action.

Unit II : Time Response Analysis: Typical test inputs, , Impulse response function, Transient Domain specifications, Analysis of first, second & higher order systems, Steady state analysis: steady state error and error constants, Dynamic error coefficients.

Unit III : 1. Stability Analysis: stability of control system, Routh Hurwitz’s stability criterion,

Unit III : 2. Roots Locus: Introduction to Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant closed loop pole pair, Root contour plots, effect of addition of zeros & poles.

SECTION-B

Unit IV : Introduction of frequency response, Bode plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.

Unit V : State Space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations, concepts of controllability and observability.

Unit VI : Sample Data Control Systems :
Representation of sampled data (Discrete) systems, review of Z-transforms, Sampler and hold ckt., Zero order hold, sampling theorem, Z-transform analysis of sampled data control systems (open & closed loop systems), Z transform of systems. Solution of difference equation by Z-transform methods. Response of discrete systems. Pulse Transform functions of open loop, closed loop systems with different sampler locations. Digital controller

& its transfer functions, Stability analysis of discrete time system using bilinear transformation.

TEXT BOOKS :

1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed. New Age International.
2. K. Ogata : Modern Control Engineering, Fourth Edition(PHI)

REFERENCE BOOKS:

1) Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11^{th} Ed., Pearson Education.
2) M. Gopal : Digital Control Systems Principles & Design (TMH)
3) Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
4) Bhattarcharya : Control System Engineering, 2^{nd} Edition (Pearson Education).

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5XN4 COMMUNICATION ENGINEERING-II

SECTION-A

Unit I : AM Transmitters : Modulation, need of modulation, AM Modulation, Frequency spectrum, Principles of DSB-FC, DSBSC, SSB-SC modulation and their comparison, Details of DSBFC Transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC Transmitter, Generation of SSB-SC by filter method, phase-shift method & third method (weavers).

Unit II : AM Receivers : TRF receiver, Superheterodyne receiver, Details of each block such as RF amplifier, mixer oscillator, IF amplifier, Diode detector, Audio Amplifier. Need and type of AGC, selectivity sensitivity, fidelity Image rejection ration, communication receiver, SNR of DSB-FC, DSB-SC & SSB-SC

Unit III : FM Transmitters : FM Modulation, Frequency Spectrum, Circuits & Analysis for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow Band and Wide Band FM, their comparison, pre-emphasis and De- emphasis. Stereo FM Transmitter.

SECTION-B

Unit IV : FM Receivers : Details of FM receiver blocks such as R.F. amplifier, local oscillator, IF amplifier, Mixer, Audio Amplifier, AGC, Limiter, FM Discriminator, Single Slope and Balanced slope detector, Analysis of Foster Seeley and ratio detectors, Stereo FM receiver, Noise in FM Reception, FM threshold effect.

Unit V : PULSE MODULATION TECHNIQUES: The sampling theorem, Sampling of Band-Pass Signal, Linear and Non linear quantization, Aliasing effect, Aperture effect, Reconstruction filter, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Time Modulation, PCM, DM, ADM

Unit VI : TELEPHONE SWITCHING TECHNIQUES: Introduction to Switching System, Pulse dialing, Touch tone dial telephone, Space Division Switching SPC, Centralized and Distributed SPC, Time Division Switching : Basic Time Division space switching, Time Division time switching, Time multiplexed space switching, Time Multiplexed time switching, EPABX.

Text Books:-

(1) Taub and Schilling D.L. : Principles of Communication Systems, McGraw- Hill Co, Tokyo, 1994 (II Ed.)

(2) Kennedy G. : "Electronic Communication System" Tata Mc-Graw Hill Co.,New Delhi (Third Edition)

(3) T. Vishwanathan : " Telecommunication Switching systems and Networks", PHI learning Private Ltd., 2009

Reference Books

(1) Wayne Tomasi, "Electronic Communication Systems", Pearson Education, third edition

(2) Simon Haykin : "Communication System, John Wiley and Sons Ltd., New York, (Third Edition), 1994

(3) B. P. Lathi : " Modern Digital and Analog Communication systems" 4^{th} Edition Oxford university Press.

(4) Hari Bhat: "Analog communication", 2^{nd} Edition Pearson India, 2010

(5) S. Kundu: " Analog and Digital communication" Pearson India 2010

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FREE ELECTIVE- I

5FEXN5 (1) CONSUMER ELECTRONICS

SECTION-A

Unit I : (8 Lectures)

Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying Systems, Equalizers and Mixers, Electronic Music Synthesizers, Commercial Sound, Theater Sound System

Unit II : (8 Lectures)

Video Systems and Displays: Colour TV standards and systems, TFT, Plasma, HDTV, Digital TV, Remote Controls, Video Telephone and Video Conferencing

Unit III : **(8 Lectures)**

Domestic Appliances: Washing machines, Microwave ovens, Air- conditioners and Refrigerators, Computers Office Systems: FAX, Xerox, Telephone Switching System, Mobile Radio System,

SECTION-B

Unit IV : **(8 Lectures)**

Recording and Reproduction Systems: Disc recording and reproduction, Magnetic recording and reproduction, Video disc recording and play back, Distortion and Noise reduction in Audio and Video System

Unit V : **(8 Lectures)**

Power Supplies and other systems: SMPS, UPS and Preventive Maintenance, Set Top Boxes, Remote controls, Bar codes, ATM, Dish washers

Unit VI : **(8 Lectures)**

Calculators: Structure, internal organization, servicing; In-Car-Computers: electronic ignition, electronic ignition lock system, Antilock Braking System (ABS), Electronically controlled Suspension (ECS), Instrument panel displays, ultrasonic car safety belt system, Air Bag System, Vehicle proximity detection system, car navigation system

Text Book:1. Consumer Electronics S P Bali Pearson Ed 2005

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FREE ELECTIVE-I
5FEXN5 (2) FIBER OPTICS
SECTION-A

Unit I : Light Ray Theory **(8 Lectures)**

Propagation of light in different media : propagation of light in an optical fiber, Basic structure and optical path of an optical fiber, Acceptance angle and acceptance cone, Numerical aperture (NA) (General), Modes of propagation, Meridional and skew rays, Number of modes and cut-off parameters of fibers.

Unit II : Losses and Dispersion in Optical Fiber **(8 Lectures)**

Fiber Losses : Attenuation in optic fibers, Materials losses, Rayleigh scattering losses, Absorption loss, Leaky modes, Bending losses, Radiation losses.

Dispersion in optical fiber : Electrical Vs. optical bandwidth. Bandwidth-length product, Intermodal dispersion, Mixing modes, Material chromatic dispersion.

Unit III : Light Sources and Detectors for Optical Fiber **(8 Lectures)**

Light Sources : Introduction, LED (Light Emitting Diode), Processes involved, structure material and output characteristics of LED, Fiber LED coupling, Bandwidth, Spectral emission of LEDs, LASERS : Operation types, Spatial emission pattern, Current Vs. output characteristics.

Detectors : Introduction, Characteristics of photo detectors (General), Photoemissive type, Photoconductive and photo voltaic devices, PN junction type, PIN photo diode, Avalanche photo diode (APD).

SECTION-B

Unit IV: Fiber optic Communication systems and Modulation **(8 Lectures)**

Fiber Communication systems : Transmitter for fiber optic communication, High performance transmitter circuit LED – Analog transmitter, LASER transmitter, Digital laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Fiber optic receiver, Fiber based modems : Transceiver.

Modulation : LED analog modulation, Digital modulation, Laser modulation, Pulse code modulation (PCM), Intensity modulation (IM).

Unit V: Optical Fiber Communication application **(8 Lectures)**

Optical fiber communication systems : Introduction, Important applications of integrated optic fiber communication technology, Long haul communication, Coherent optical fiber communication, Principle of coherent detection.

Unit VI : Measurements on Optical Fibers **(8 Lectures)**

Introduction, Measurements of numerical aperture (NA),Measurements of Fiber- attenuation, Optical time Domain Reflectometry (OTDR), Measurements of dispersion losses, Measurements of refractive index, Cut-off wavelength measurement, Measurements of Mode Field Diameter (MFD),

Text Books:

1. Optical Fiber Communications : Principles and Practices- John M. Senior (PHI)
2. Optical Fiber and Optical Fiber Communication Systems S. K. Sarkar (S. Chand and Co.)

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5XN6 COMMUNICATION SKILLS

Unit I : Comprehension over an unseen passage. Comprehension –A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Comprehension - B - Structure study :-Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization.

Unit II : **Theoretical background -** Importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content. Non-verbal communication, types of graphics and pictorial devices.

Unit III : Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. Methodology of conduction of meetings, seminars, symposia, conference and workshop.

BOOKS RECOMMENDED:

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.

2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.

3) Raman Sharma “Technical Communication”, Oxford University Press..

4) F. Frank Candlin : General English for Technical Students, University of London Press Ltd.

5XN7: Electronic Devices & Circuits-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN1(Electronic Devices & Circuits-II)

5XN8: Power Electronics Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN2(Power Electronics)

5XN9: Communication Engineering-II Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN4 (Communication Engineering-II)

5XN10: Communication Skills Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 5XN6 (Communication Skills)

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6XN1 DIGITAL INTEGRATED CIRCUITS

SECTION-A

Unit I : Combinational Logic Design: Function of binary variables, Boolean Algebraic Theorems, Standard form of logic functions, K-Map up to 5 variables, Quine McCluskey Method, Don’t Care Conditions and its effects, Synthesis using AND-OR Gates **(8 periods)**

Unit II: Combinational Logic Design using 74/54 MSI chip series concerning to MUX, DEMUX, Decoders, Encoders, Comparators, Code converters, Priority Encoders, Parity Generator/Checker and BCD to Seven Segment Decoders **(8 periods)**

Unit III: Combinational Logic Design using ROM array, PLA, PAL, preliminary design concepts using FPGAs, N-bit binary adder using 7480, Look-ahead carry adder construction **(8 periods)**

SECTION-B

Unit IV: Design of counters and sequential networks. Analysis of clocked sequential networks, general models of sequential machines, equivalence and minimization networks, deviation of state graphs and tables, reduction of state assignments, SM charts **(8 periods)**

Unit V: Analysis of asynchronous sequential networks, derivation and reduction of primitive flow tables, state assignments and realization of flow tables, hazards, , asynchronous sequential network design **(8 periods)**

Unit VI: Fault detection and location in combinational circuits. Paths sensitizing method, equivalent – normal – Form method (ENF), two level fault detection, fault detection and location in sequential circuit using circuit test approach **(8 periods)**

Textbooks:

1. Charles H. Roth, “Fundamentals of Logic Design”, 4th Edition, Jaico Publication
2. Lee S. C., “Digital Circuit and Logic Design”, PHI
3. Jain R. P. “Modern Digital Electronic Circuits and Systems”, TMH

Reference Books:

1. Digital IC Reference data manuals
2. Texas Instruments Inc. Design with TTL ICs
3. Morris Mano, “Digital Electronics: Circuits and Systems”, PHI
4. Parag K. Lala, “Fault tolerance and fault testable hardware design, B. S. Publications, Hyderabad

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6XN2 LINEAR INTEGRATED CIRCUITS
SECTION-A

Unit I: Operational Amplifier, block diagram of op-amp, Differential amplifier: gain expressions using h - parameters, constant current source, level shifting, transfer- characteristics, frequency response, frequency compensation methods, study of ICuA741, measurement of parameters of op-amp and offset nulling and their importance.

Unit II: Linear Applications of Op-Amp: Inverting and non inverting amplifiers, voltage followers (AC & DC), integrator, differentiator, differential amplifier, instrumentation amplifiers, precision rectifiers, RMS to DC converter, voltage to current converter, sinusoidal RC oscillators, constant voltage sources, frequency to voltage and voltage to frequency converter.

Unit III: Non Linear Applications of Op-Amp and Filter Circuits: Clipping and clamping circuits, comparator, zero crossing detector, Schmitt trigger, peak detector, astable, monostable and bistable multivibrator, voltage sweep generator.
Active filters : Butterworth filters using op-amp. Log and Antilog amplifiers.

SECTION-B

Unit IV: Voltage Regulator: Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78**, 79**, and LM 317.

Unit V: 1. Timers : Block schematic of IC 555, application of timer 555 as astable, monostable and bistable multivibrators, frequency divider, pulse stretcher, sawtooth generator, free running ramp generator, FSK generator.
2. Sample & hold circuit.

Unit VI: 1. PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its applications as AM detector, FM detector and frequency translator.
2. Introduction to Audio Function Generator IC 8038.

Text Books :-

1) Gayakwad R.A. : OP-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (Second Edition), 1980.
2) Robert F. Coughlin, Frederick F. Driscoll: Operational Amplifier and Linear Integrated Circuits, Sixth Edition, PHI Pub.

Reference Books :

1) Tobey J.E. and Grame J.E. : Operational Amplifier Design and Applications, International Student Edition, 1983.
2) T.R. Ganesh Babu, B. Suseela: Linear Integrated Circuits, Third Edition, Scitech Pub.

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6XN3 INTRODUCTION TO MICROPROCESSORS
SECTION-A

Unit I : 8085 : Architecture, Register Structure, Addressing modes, Instruction set of 8085, Timing diagrams.

Unit II : Assembly Language Programming of 8085, Introduction to assemblers, Simulators, Stack, Subroutine. Address space partitioning schemes: Memory mapped I/O and I/O mapped I/O, Address decoding techniques.

Unit III: Interrupt system of 8085, software and hardware interrupts, Data transfer schemes: Serial data transfer through SOD and SID, USART 8251 and its interfacing.

SECTION-B

Unit IV : Internal architecture, programming and interfacing of PPI 8255, programmable interval Timer/ Counter 8254, Introduction to DMA data transfer , DMA Controller 8237 and its interfacing.

Unit V : 8086 : CPU architecture, internal operations, addressing modes, instruction formats, execution timing.

Unit VI : Instruction set of 8086, Assembly language programming (ELEMENTARY PROGRAMMING) Assembly Directives, Operators.

Text Books :

1) Gaonkar R.S. : Microprocessor Architecture Programming and Applications with the 8085, Penram International Pub. (Third Edition), 1997.

2) A. K. Ray and K. M. Bhurchandi: Advanced Microprocessors and Peripherals, Architecture Programming and Interfacing, TMH.

3) Gibson G.A., Liu Y.C. : Microcomputer system the 8086/8088 family, Prentice Hall India Pvt. Ltd.

Reference Books:

1) Hall D.V. : Microprocessor and Interfacing Programming and Hardware, McGraw Hill Co., New York, 1986.

2) Data sheet manuals by INTEL.

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6XN4 RADAR & TELEVISION ENGINEERING

SECTION - A

Unit I : Radar : The Radar equation-Pulse Radar-CW Radar- CW Radar with non zero IF, equation for Doppler frequency- FM-CW Radar using sideband superhetrodyne receiver, MTI Radar-Delay line canceller, MTI Radar with power amplifier & power oscillator, Non coherent MTI Radar, Pulse Doppler Radar

Unit II : Radar Transmitters. Radar Modulator-Block diagram. Radar receivers- noise figure, low noise front ends, Mixers – Different types of Displays – Duplexers- Branch type and balanced type. Navigation- Loop Antenna, Radio compass. Hyperbolic Systems of Navigation, LORAN – A. Distance Measuring Equipment . Instrument Landing System – Localizer, Glide Slope, Marker beacons.

Unit III : Television: Scanning, Blanking and synchronisation, Picture signal - composite video signal- Vestigial sideband transmission-Principle of CCD Camera - Monochrome picture tube- Monochrome TV receivers- RF tuner ,VHF tuner- Video amplifier, IF section, Vestigial sideband correction- Video detectors

SECTION - B

Unit IV : Sound signal separation, AGC, sync separation, horizontal and vertical deflection circuits, EHT generation. Colour TV system: Principle of colour signal transmission and reception, PAL, NTSC, SECAM (block schematic description), Picture tube – delta gun.

Unit V: Digital TV: Digitized Video, Source coding of Digitized Video compression of Frames – DCT based – (JPED), Compression of Moving Pictures (MPEG). Basic blocks of MPEG2 and MPEG4. Digital Video Broadcasting (DVB) – Modulation: QAM – (DVB-S, DVB-C)

Unit VI: OFDM for Terrestrial Digital TV (DVB –T). Reception of Digital TV Signals (Cable, Satellite and terrestrial). Digital TV over IP, Digital terrestrial TV for mobile. Display Technologies – basic working of Plasma, LCD and LED Displays.

Text Books:

1. Merrill I. Skolnik: Introduction to Radar Systems,3/e, Tata McGraw Hill,
2. N.S.Nagaraja: Elements of Electronic Navigation, 2/e, Tata McGraw Hill
3. R.R. Gulati: Monochrome and Colour Television. New Age international, 2008.
4. Herve Benoit, Digital Television Satellite, Cable, Terrestrial, IPTV, Mobile TV in the DVB Framework, 3/e, Focal Press, Elsevier, 2008

Reference Books:

1. Shlomo Ovadia: Broadband Cable TV Access Networks, PH-PTR, 2001
2. Byron Edde: Radar Principles, Technology & Applications, Pearson Education.
3. Mark E Long: ¯The Digital Satellite TV Hand Book, Butterworth-Heinemann.
4. K.R.Rao, J.O.Hwang, Techniques and standards for Image, Video and Audio coding, Prentice Hall,1996
5. John Arnold, Michael Frater, Mark Pickering, Digital Television Technology and Standards, John Wiley & Sons, Inc, 2007
6. Robert L. Hartwig, Basic TV Technology: Digital and Analog, 4/e, Focal Press, Elsevier, 2005

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FREE ELECTIVE - II

6FEXN5 (1) INTRODUCTION TO WIRELESS TECHNOLOGY

SECTION-A

Unit I : (8 Lectures)

Introduction to networking: the Internet reference model, layering and protocols, OSI and other models, Network types, network media, network topologies, connectivity devices, evolution of networking, types and range of wireless communication, wireless technologies

Unit II : (8 Lectures)

Wireless LAN, satellite communication, wireless application protocol (WAP), antennas, narrow-band and spread-spectrum technologies, cellular telephony, propagation, frequencies and spectrum and personal communication system

Unit III : (8 Lectures)

Wireless Application Protocol model, WAP architecture component, Trends: technology and culture, 3G, wireless in local proximity, Bluetooth: design and principle of operation, transmitter characteristics, spurious emissions, baseband characteristics, physical channel, channel control, Bluetooth security, inter-operability requirements for blue-tooth as a WAP bearer

SECTION-B

Unit IV : (8 Lectures)

Cellular telephony, history of cellular telephony, design and principle of cellular operation, cellular telephony operation, analog cellular telephones, digital cellular telephones, digital networks, personal communication systems, the third generation, recent events in cellular telephony

Unit V : (8 Lectures)

Wireless LAN: introduction, benefits of WLANs, design and principle of operation, WLAN configuration, micro-cells and roaming, types of WLANs, WLAN customer consideration, wireless LAN standards, IEEE 802.11, 802.11b and 802.11a, selecting the WLAN, microwave LANs

Unit VI : (8 Lectures)

Communicating with a satellite, LEOs, MEOs, GEOs and HEOs systems, design and principle of operation of Global Positioning System (GPS); satellite, control and user segments, Differential GPS, geometric earth models and future of GPS

Textbook: An Introduction to Wireless Technology by Garry S. Rogers and John Edwards, Pearson Education

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FREE ELECTIVE II

6FEXN5 (2) ELECTRONIC TEST INSTRUMENTS: ANALOG AND DIGITAL

SECTION-A

Unit I : (8 Lectures)

Analog meters, digital meters, dc voltmeter, ac voltmeters, RF probes, ammeters, ac ammeters, ohm-meters, 4-wire ohm measurements, multi-meters, meter range, other multi-meter functions: continuity indicators, diode tests, frequency counters, minimum, maximum, average read-outs, capacitance and temperature measurements, specifications

Unit II : (8 Lectures)

Floating and grounded outputs, sine wave sources, imperfections in sine wave sources,: frequency accuracy, frequency stability, amplitude accuracy, distortion, spurious responses, close-in-sidebands , Function Generators: Arbitrary waveform generators, arbitrary waveforms, AM and FM modulation, bursts, Frequency Shift Keying, Frequency sweep, sync output, phase locking, pulse generators, RF signal generators

Unit III : (8 Lectures)

Oscilloscopes: the concept of oscilloscope, digital scope block diagram, sample rate, real time and repetitive sampling, triggering, acquisition/sweep control, vertical amplifier, vertical resolution, ac and dc coupling, bandwidth limit, X-Y display mode, High impedance inputs, 50 ohm inputs, digital acquisition and display techniques, specifications of oscilloscopes, mixed signal oscilloscope, oscilloscope probes, probe compensation, active probes, differential measurements, high voltage probes, current probes

SECTION-B

Unit IV : (8 Lectures)

Oscilloscope measurements, basic waveform measurements, voltage gain measurements, phase measurements, frequency measurements, digital signal measurements, frequency response measurements, square wave tests, linearity measurements, curve tracer measurement techniques, diode I-V and resistor I-V characteristics, amplitude modulation measurements, power measurements, FFT measurements, basic time domain reflectometry

Unit V : (8 Lectures)

Spectrum and network analyzers: spectrum analyzer, bank-of-filters spectrum analyzers, FFT spectrum analyzers, wave-meters, resolution bandwidth, narrow-band and broadband measurements, swept spectrum analyzers, spectrum analyzer measurements, Network Analyzers, distortion analyzers, RF power measurements, RF power meter,

Unit VI : **(8 Lectures)**

Logic Analyzers: logic probes, oscilloscope logic measurements, logic analyzers, timing analyzers, glitch detect, state analyzers, data formats, state displays, timing displays, microprocessor measurements, trigger events and sequencing, microprocessor program flow, logic analyzer probing, combined scope and logic analyzer, PC-hosted logic analyzers

Text Book: Electronic Test Instruments: Analog and Digital by Robert A. Witte, Second Edition, Pearson Education

6XN6: Digital Integrated Circuits Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XN1(Digital Integrated Circuits)

6XN7: Linear Integrated Circuits Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XN2 (Linear Integrated Circuits)

6XN8: Introduction to Microprocessors Lab

Minimum 8 experiments uniformly distributed based on the syllabus of 6XN3 (Introduction to Microprocessors)

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FOUR YEAR DEGREE COURSE IN
B TECH CHEMICAL ENGINEERING
SEMESTER - V
CREDIT & GRADE SYSTEM
5CH01 HEAT TRANSFER

Objective:

To introduce the concepts of heat transfer to enable the students to design components subjected to thermal loading.

SECTION-A

UNIT I: Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension. Fourier's law. Heat transfer through plane, cylindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design and operation, introduction to unsteady state heat transfer. **(7)**

UNIT II: Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection. Dimensional analysis applied to heat transfer. Dittus-Boelter equation, Limitations and application. **(7)**

UNIT III: Heat transfer by parallel and counter current flow, concept of log mean temperature difference, rate of heat transfer. Heat transfer by film wise and drop wise condensation in horizontal & vertical tube. **(7)**

SECTION-B

UNIT IV: Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers. **(8)**

UNIT V: Boiling and Evaporators: Theory of boiling. Classification, types and field applications of evaporators. Single and multiple effect evaporators. Heat transfer through submerged coils, jacketed vessels. **(8)**

UNIT VI: Heat transfer by radiation, concept of black body, Kirchhoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidized beds.

Recent developments and technological forecasting in heat transfer. **(8)**

Text Books:

1) Heat Transfer by Sukhatme
2) Heat Trasnfer by Mc Adams

Reference Books:

1) Unit Operations of Chemical Engineering by McCab and Smith
2) Chemical Engineering by Coulson & Richardson, Vol. I
3) Heat Transfer by R.C.Sachdeva

5CH02 CHEMICAL ENGINEERING PROCESS-I
(Inorganic Chemical Technology)

Chemical Engineers are trained primarily to work in chemical industries. Its basic purpose is to start from one ore or other chemical raw material and end up with a consumer product through series of chemical and physical changes, and here it differs from other manufacturing industries which are assembly industries not creative industries. It will be shown in the study of a number of types of chemical industrial process that the fundamentals chemistry, thermodynamics, kinetics, engineering and economics are always valid.

Objective:

After studying this subject the chemical engineering student will have a comprehensive picture of the chemical industry, particularly as to the reasons and the basis for many and diverse operations which are carried out in process.

SECTION A

UNIT-I : 1. Sugar and Starch Industries: Sugar, Starches and related products.
2. Soap and Detergents: Detergents, Soap and Glycerin. **(7)**

UNIT-II: 1. Pulp and Paper Industries: Types, raw materials, manufacture of pulp and paper.
2. Cement and Lime Industries: Portland Cement, types, raw materials, setting and hardening of cement, manufacturing processes of Portland cement; Manufacture, use of lime and gypsum. **(8)**

UNIT-III: 1. Industrial Gases: Manufacture and application of carbon dioxide, hydrogen, oxygen, nitrogen.
2. Fuel Gases: Manufacture and uses of producer gas, water gas, natural gas, synthesis gas. **(8)**

SECTION B

UNIT-IV: 1. Acids: Sulfuric acid, nitric acid, hydrochloric acid.
2. Fertilizer Industry: Manufacture of ammonia, urea, diammonium phosphate, super phosphates (SSP and TSP) **(8)**

UNIT-V: Principles of electro-chemical technological process; Electrolytic process in igneous and molten system; caustic soda, chlorine. **(7)**

UNIT-VI: Electro-thermal Industries: aluminum, lithium, titanium. Electro-chemical sources of energy and storage. **(7)**

Note: The students are expected to visit the various industries to have a thorough understanding of the subject.

Text Books:

1. Austin, G.T., “Shreve’s Chemical Process Industries “, Fifth Edition, McGraw-Hill International Book Co, Singapore, 1984.
2. Dryden, C.E., “Outlines of Chemical Technology “, Edited and Revised by Gopala Rao M.and M. Sittig, Third edition, Affiliated East-West press, 1997

Reference Books:

1. Kent, J.A., “Riggel’s Hand Book of Industrial Chemistry “, 7th Edition, Van Nostrant Reinhold, 1974.
2. CHEMTECH 1-4, “Chemical Engineering Education Development Centre “, I.I.T., Madras 1975-78.

5CH03 ECONOMICS & MANAGEMENT

Engineers are trained primarily to work in industries, market as managers. They should have knowledge about the basic concepts of economics, latest developments in the field, foreign trades, banking, etc. As a manger they should have basic knowledge about management from production to marketing.

Objective:

After studying this subject the engineering student will have understanding of the happenings in the field of economics and preliminary idea about management.

SECTION A

UNIT-I: Nature and scope of economics, Demand and Supply, Demand: concepts, specification, types of demand. Demand Analysis: significance of demand analysis, law of diminishing utility, consumer surplus. Demand Forecasting: concept of forecasting, types of forecast, steps in demand forecasting, techniques of demand forecasting. **(8)**

UNIT-II: Market: Meaning, types of market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition. Inflation: Causes, measurement, effects, controlling of inflation. **(7)**

UNIT-III: Nature and characteristics of Indian economy, Privatization – meaning, merits and demerits.
Globalisation of Indian economy – merits and demerits. Concepts of VAT, WTO, GATT & TRIPS agreement, Banking, Foreign exchange.
(8)

SECTION B

UNIT-IV: Basic concepts and functions of Management, Personal Management. Production Management: Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Concepts of material management, inventory control; its importance and various methods. **(8)**

UNIT-V: Marketing Management: Definition of marketing, marketing concept, objectives and functions of marketing.
Marketing Research – Meaning; Definition; objectives; Importance; Limitations; Process.
Advertising – meaning of advertising, objectives, functions, criticism. **(7)**

UNIT-VI: Financial Management: Introduction, Objectives of Financial Management, Functions and Importance of Financial Management. Concept of capital structure and various sources of finance. **(7)**

Text Books:

1. Modern Economic Theory – K.K. Dewett, S.Chand
2. Principles and Practice of Management: R.S. Gupta, B.D.Sharma, N.S. Bhalla Kalyani Publishers

Reference Books:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Micro Economic Theory – H.L. Ahuja (S.Chand)
3. Indian Economy: Rudar Dutt & K.P.M. Sundhram
4. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
5. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).
6. Financial Management – I.M. Pandey (Vikas Publishing House, New Delhi)

5CH04 MATERIAL SCIENCE & ENGINEERING

Materials Science & Engineering is the study of mechanical, physical, and chemical properties of engineering materials, such as metals, ceramics, polymers, and composites.

Objectives: The objective of a Materials Engineer is to predict and control material properties through an understanding of atomic, molecular, crystalline, and microscopic structures of engineering materials.

SECTION A

UNIT I : Introduction to materials and their principle properties, Simple stresses and strains, Concept of stress, strain, shear stress, shear strain, Hooks law, Elastic limit, stress-strain curve for mild steel and elastomeric materials, factor of safety, Poisson's ratio, Strain energy due to axial load and impact. Introduction to determination of mechanical properties of materials ASTM methods. **(7)**

UNIT II: Basic principles in their selection for fabrication and erection of chemical plant. Testing of materials, destructive and nondestructive tests, structure of atom and chemical bonds, crystal structures and their influence on material properties, Deformation and slip processes. **(7)**

UNIT III: Metals and their alloys: Iron – carbon diagram, Ferrous and nonferrous alloys, mild steel, special steels, stainless steels, brasses, brasses, aluminum alloys and titanium alloys, high and low temperature material, insulation, refractories. Methods for fabrication, rolling, bending, central punching, revetting, welding. Nickel and its alloys: aluminum and its alloys. **(8)**

SECTION B

UNIT IV: Corrosion and its control: Corrosion attack methods, Different types of corrosion: chemical, biochemical, and electrochemical; Internal and external factors affecting corrosion of chemical equipments, Methods to minimize corrosion, corrosion charts for process equipments.
Polyaniline and anticorrossive surface coatings electrochemical corrosion prevention corrosion case studies from the chemical industry. **(8)**

UNIT V: Polymers, natural and synthetic: Selection of polymetric materials for equipment linings, fiber reinforced plastic, application of special polymers like Nylon 66, Teflon in engineering. Polymer
Composites. **(7)**

UNIT VI: Ceramic and glasses: Definition of ceramics and glasses; interaction between structure, processing, and properties; Applications of ceramic and glass materials; Crystalline and noncrystalline ceramics, silicates, refractories, clays, cements, glass vitreous silica, and borosilicate. **(7)**

Text Books:

1. James F. Shacketford, Introduction to Material Science, McMillan publishing company, New York ISBN 1990
2. D.Z. Jestrazebaski, Properties of Engineering Materials, 3rd Ed. Toppers. Co. Ltd.

Reference Books:

1. J.L. Lee and Evans, Selecting Engineering materials for chemical and process plants, Business Works 1978
2. Design of machine elements, Spott M.M. Prentice Hall
3. A text book of machine design, Khurmi R.S. and Gupta J.K.
4. Material Science & Metallurgy for Engineers, Dr.V.D.Kodgire, Everest Publishing House.

5FECH05 FREE ELECTIVE - I

5FECH05 (1) AIR POLLUTION CONTROL

Objective:

This subject covers the sources, characteristics and effects of air pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

SECTION A

UNIT I: Sources of air pollution: Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution –Source inventory. **(7)**

UNIT II: Effects of air pollution: Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles. **(8)**

UNIT III: Dispersion of pollutants: Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models–Applications. **(7)**

SECTION B

UNIT IV: Air Pollution Control: Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion –Pollution control for specific major industries. **(8)**

UNIT V: Air Quality Management: Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts– Zoning – Town planning regulation of new industries – Legislation and enforcement –Environmental Impact Assessment and Air quality. **(8)**

UNIT VI: Sampling and Analysis: Basic principle of sampling – Statistical Techniques - Source and ambient sampling – Analysis of Gaseous and Particulate pollutants - Standards. **(7)**

Text Books:

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi,1996

Reference Books:

1. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996
2. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark, 1997
3. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991
4. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985
5. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi
6. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw-Hill, New Delhi,1991

5FECH05 (2) RISK AND SAFETY MANAGEMENT IN INDUSTRIES

Public awareness of hazards and risks has enhanced the importance of safety assessment andmanagement in today’s increasingly litigious society. Worldwide the burden of responsibility for safety is shifting towards those who own, manage and work in industrial and commercial organizations. The management of safety and risk needs to be integrated into the overall

management of the organization. It should be appropriate and cost-effective without dampening the innovative entrepreneurial spirit of employees with inflexible bureaucratic rules and procedures. An organization’s exposure to potential hazards needs to be managed so as to reduce the chance of loss and mitigate any effects. Risk and safety issues need to be evaluated in a structured and calculated manner but in the light of an overall organizational strategy.

SECTION A

UNIT-I: Hazard identification methodologies, risk assessment methods - PHA, HAZOP, MCA, ETA, FTA, consequence analysis, probit analysis. **(8)**

UNIT II : Hazards in work places - nature and type of work places, types of hazards, hazards due to improper house-keeping, hazards due to fire in multi-floor industries and buildings, guidelines and safe methods in the above situations. **(7)**

UNIT- III: Workers' exposures to hazardous chemicals, TLVs of chemicals, physical and chemical properties of chemicals leading to accidents like fire explosions, ingestion and inhalation, pollution in work places due to dangerous dusts, fumes and vapours, guidelines and safe methods in chemicals handling, storage and entry into confined spaces. **(8)**

SECTION B

UNIT- IV: Hazards peculiar to industries like fertilizer, heavy chemicals, petroleum, pulp and paper, tanneries, dyes, paints, pesticides, glass and ceramics, dairy and sugar industries, guidelines for safeguarding personnel and safeguarding against water, land and air pollution in the above industries. **(8)**

UNIT- V: Safety education and training - safety management, fundamentals of safety tenets, measuring safety performance, motivating safety performance. **(7)**

UNIT VI: Legal aspects of industrial safety, safety audit. **(7)**

Text Books:

1. F. P. Lees, "Loss prevention in process industries", 2nd, Butterworth-Heinemann, 1996.
2. W. Handley, "Industrial safety handbook", 2nd ed., McGraw-Hill, 1977.

Reference Books:

1. S. P. Levine, "Protecting personnel at hazardous waste sites", Martin-Butterworth, 1971.
2. R. P. Blake, "Industrial safety", Prentice Hall, 1953.
3. D. Patterson, "Techniques of safety management", McGraw-Hill, 1978.

5CH07 HEAT TRANSFER - LAB

List of Experiments:

1. Heat conduction
2. Natural convection
3. Thermal radiation-determination of emissivity
4. Double pipe heat exchanger
5. Shell and tube heat exchanger
6. Plate Heat exchanger
8. Heat transfer in agitated vessels
9. Double effect evaporator
10. Open pan evaporator
11. Heat pipe demonstrator
12. Fluidized bed heat transfer

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

5CH08 MATERIAL SCIENCE & ENGINEERING -LAB

List of Experiments:

1. Microstructure observation and study of metals and alloys. (Minimum five) low carbon steel, medium carbon steel, high carbon Steel, tin, bronze, brass, phosphor bronze.
2. Study of properties of polymeric materials; impact test and polymeric Tests.
3. Corrosion testing (salt spray test for different samples such as plain carbon steel, chrome plate steel, galvanized steel.)
4. Different types of hardness test on metals, i.e. Rockwell hardness test, Brinell hardness test, Shore scleroscope tests.
5. Izod and Charpy impact test on mild steel, copper, brass and aluminium.
6. Chemical analysis of metals and alloys (Any one element to be analysed e.g. molybdenum from stainless steel, carbon from steel, copper from brass etc.
7. Macrostructure observation: (flow lines observation in forging by macro etching sulphur printing of steel.)
8. Study experiments based in, i) Dye penetration ii) Rubber lining, iii) Ultrasonic test, iv) Heat treatments.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

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6CH01 CHEMICAL ENGINEERING OPERATION-II (MASS TRANSFER-I)

SECTION-A

UNIT I: Importance of Mass Transfer Operation. Classification of mass transfer, operations based on gasliquid-solid contacts. Concepts of flux, resistance, driving force, equilibrium, direction of mass transfer, Dimensionless numbers in mass transfer. Diffusion, Fick's law I and II,
Dependence of diffusivity on physical properties, Schmidt's no. calculation, Determination of diffusivity in liquid-liquid, gas-gas, gas-liquid diffusion. **(7)**

UNIT II: Interphase mass transfer, various coefficient of mass transfer and their determination, resistance concept, controlling phase concept, Mass transfer in turbulent flow, Analogies of mass transfer, Empirical equations. Theories of mass transfer, two film theory, Higbies penetration theory, Derivation of flux equation, surface renewal theory, Applications and problems. **(7)**

UNIT III: Absorptions, stagewise absorption, material balance overall, stepwise minimum irrigation rate, Absorption and stripping factor calculation of number of stages, McCabe-Thiele graphical method, Kremsor-Brown-Sounder's equation. Equipments of absorption, tray towers, packed towers. Continuous absorption, concept of HTU, NTU, HETP, comparison with stepwise columns, design concepts, determination of height and diameter of packed absorption column. **(8)**

SECTION-B

UNIT IV: Adsorption: Adsorption equilibria, types of adsorption, properties of adsorbents, single and multi-stage adsorption, adsorption isotherms, principles of adsorption, Break through curves, adsorption of liquids, basic equations, adsorber design, adsorption equipments. Ion Exchange: Principles of ion exchange, techniques and applications, Ion exchange equilibria, rate of ion exchange. **(7)**

UNIT V: Drying and humidification: Principles of drying, phase equilibrium, cross circulation drying, through circulation drying, drying of suspended particles, rate of drying curve, dryers for solids and pastes, dryers for solutions and slurries, i.e. various types of dryers, Humidification: Terms, definitions, wet bulb temp., dry bulb temperature and measurement of humidity, adiabatic saturation temperature, study of

temperature humidity chart, Enthalpy-humidity charts, determination of humidity, and concept of dehumidification, equipments for humidification operations. **(8)**

UNIT VI: Crystallisation: Principles of crystallisation, equilibria, calculation of yield, heat effects, crystal growth, properties of crystals nucleation, fractional crystallisation, caking of crystals, Various types of crystallise's and their applications. Membrane separation process, Types of membrane, separation of gases, separation of liquids, Dialysis, Reverse Osmosis, pervaporisation, desalination. Recent developments in mass transfer operation. **(8)**

Text Books:

1) Unit Operation in Chemical Engineering: W.L. McCabe & J.C. Smith, McGraw Hill
2) Mass Transfer Operation: R.E. Treybal

Reference Books:

1) Mass Transfer: T.K. Sherwood, R.I. Pigford, McGraw Hill
2) Chemical Engineering: Coulson & Richardson

6CH02 CHEMICAL ENGINEERING PROCESS-II (Organic Chemical Technology)

Chemical Engineers are trained primarily to work in chemical industries. Its basic purpose is to start from one ore or other chemical raw material and end up with a consumer product through series of chemical and physical changes, and here it differs from other manufacturing industries which are assembly industries not creative industries. It will be shown in the study of a number of types of chemical industrial process that the fundamentals chemistry, thermodynamics, kinetics, engineering and economics are always valid.

Objective:

After studying this subject the chemical engineering student will have a comprehensive picture of the chemical industry, particularly as to the reasons and the basis for many and diverse operations which are carried out in process.

SECTION A

UNIT I :
1. Fermentation Industries: Industrial alcohol, absolute alcohol, wine.
2. Organic acid production: Acetic acid, lactic acid, citric acid. **(7)**

UNIT II :
1. Polymerization Industries: Polyethylene, polypropylene, PVC, polyester synthetic fibers.
2. Rubber Industries: Natural rubber, synthetic rubber, SBR. **(8)**

UNIT III: 1. Petroleum Refinery: Refining of crude oil, products of refining.

2. Petrochemicals: Significant petrochemicals and their derivatives. **(8)**

SECTION B

UNIT IV: 1. Nitration: Nitration agents, kinetics, mechanism, industrial preparation of nitrobenzene, nitronaphthalene, chloro-nitronaphthalene, nitroacetanilide.

2. Sulphonation and Sulfation: agents, kinetics, mechanism, technical preparation of aliphatic sulphonates, sulphonation of lauryl alcohol, dimethyl ether. **(8)**

UNIT V: 1. Hydrogenation: Catalytic hydrogenation, kinetics, mechanism, hydrogenation of fatty oils, synthesis of methanol.

2. Hydrolysis: Hydrolysis of fat, carbohydrate, starch: Manufacture of ethanol from ethylene, manufacture of phenol. **(7)**

UNIT VI: 1. Halogenation: Technical preparation of halogen compounds- allyal chloride, DDT, BHC, chlorobenzene, vinyl chloride.

2. Oxidation: Liquid and vapour phase oxidation, technical oxidation of isopropyl benzene, naphthalene, benzene, ethyl benzene, naphthalene sulfonic acid. **(7)**

Note: The students are expected to visit the various industries to have a thorough understanding of the subject.

Text Books:

1. P.H. Groggins, “Unit Processes in Organic Synthesis”, McGraw Hill Book Co., Kogakusha (1984)
2. J.A. Kent, “Riegel’s Hand book of Industrial Chemistry”, 7th Edition, Van Nostrand Reinhold Co., New York (1974)

Reference Books:

1. Peter Wiseman, “An Introduction to Industrial Organic Chemistry”, 2nd Edition, Applied Science Publishers Ltd., London (1979)
2. CHEMTECH 1-4, “Chemical Engineering Education Development Centre “, I.I.T., Madras 1975-78

6CH03 COMPUTER PROGRAMMING & APPLICATIONS

Application of the following techniques is for problems of interest in chemical engineering, writing and testing of programs in C Language.

SECTION-A

UNIT I: Numerical solution of first order differential equations with initial condition, Euler’s method,Runge-Kutta method. **(7)**

UNIT II: Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method. **(7)**

UNIT III: Roots of algebraic and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental and algebricequations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems. **(8)**

SECTION-B

UNIT IV: Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial. **(7)**

UNIT V: Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods. **(8)**

UNIT VI: Computer programming in modular form, use of subroutine libraries, Block diagrams of preliminary aids in programming, capacity optimization. **(8)**

Text Books:

1. Digital Computation for Chemical Engineering by Leon Lapidas, McGraw Hill.

6CH04 PROCESS EQUIPMENT - DESIGN & DRAWING

SECTION - A

UNIT I: Material behaviour under stresses, theories of failures. **(7)**

UNIT II: Fabrication methods and their effects: Design method for atmospheric storage vessels, unfired pressure vessel subjected to internal and external pressure. **(7)**

UNIT III: Vessels for high pressure operations, Agitated vessels. Tail columns, internals of the reactors. **(8)**

SECTION - B

UNIT IV: Design of process equipment accessories and support systems. **(7)**

UNIT V: Complete design and preparation of working drawing for typical process equipment, such as large storage vessels, thick wall pressure vessels. Self supported tall columns, agitated pressurevessels with heat transfer requirements etc. **(8)**

UNIT VI: Design and layout of piping system and preparation of piping diagram for a typical process.
Material selection and piping coding. **(8)**

Note: Drawings of minimum eight design problems are expected.

Text Books:

1) Process Design of Equipments: S. D. Dawande
2) Process Equipment Design: M.V. Joshi, McMillan

Reference Books:

1) Introduction to Chemical Engineering Design, Mechanical Aspects
2) I.S. Code for Unfired Pressure: IS No. 2825 - 1969 pressure vessel
3) Process Equipment Design: I.E.Brownell, E.H.Young, John Wiley
4) International & Indian Standard codes for Piping

6FECH05 FREE ELECTIVE-II
(1) RENEWABLE ENERGY SOURCES

Objectives:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To analysis the environmental and cost economics of using renewable energy sources compared to fossil fuels.

Course-Outcome:

- At the end of the semester the student will have knowledge about various renewable energy sources and be able to choose the appropriate renewable energy as an alternate for conventional power in any application.

SECTION A

UNIT I : Solar-Energy : Solar radiation its measurements and prediction - solar thermal flat plate collectors concentrating collectors - applications - heating, cooling, desalination, power generation, drying, cooking etc - principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. **(7)**

UNIT II: Wind-Energy : Atmospheric circulations - classification - factors influencing wind - wind shear - turbulence - wind speed monitoring - Betz limit - Aerodynamics of wind turbine rotor-site selection - wind resource assessment - wind energy conversion devices - classification, characteristics, and applications. Hybrid systems - safety and environmental aspects. **(8)**

UNIT III: Bio-Energy : Biomass resources and their classification - chemical constituents and physicochemical characteristics of biomass - Biomass conversion processes - Thermo chemical conversion: direct combustion, gasification, hydrolysis and liquefaction - biochemical conversion: anaerobic digestion, alcohol production from biomass - chemical conversion process: hydrolysis and hydrogenation. Biogas - generation - types of biogas Plants- applications. **(7)**

SECTION B

UNIT IV : Hydrogen and Fuel Cells: Thermodynamics and electrochemical principles - basic design, types, and applications, production methods, Biophotolysis: Hydrogen generation from algae biological pathways, Storage gaseous, cryogenic and metal hydride and transportation. Fuel cell: principle of working, various types, construction and applications. **(8)**

UNIT V: Other Types of Energy : Ocean energy resources, principles of ocean thermal energy conversion systems, ocean thermal power plants, principles of ocean wave energy conversion and tidal energy conversion, hydropower, site selection, construction, environmental issues, geothermal energy, types of geothermal energy sites, site selection, and geothermal power plants. **(8)**

UNIT V: Analysis of the cost effectiveness of renewable energy sources, present status, comparison, forecast. **(7)**

Text Books:

1. Rai G. D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 2007
2. John Twidell, Tony Wier, ‘Renewable Energy Sources’, Taylor & Francis Publishers, New York, 2005

Reference Books:

1. Sukhatme, S.P., Solar Energy, Tata McGraw - Hill Publishing Company Limited, 2006

2. Khandelwal K.C, Mahdi S.S., Biogas Technology - A Practical Handbook, Tata McGraw Hill, 1986
3. Thomas .b. Johansson, Henry Kelly, Amulya K.N .Reddy, Robert .H. Williams, 'Renewable Energy Sources for Fuels and Electricity', Island Press, Washington DC, 2009
4. Anthony San Pietro, Biochemical and Photosynthetic aspects of Energy Production, Academic Press, 1980

FREE ELECTIVE - II
6FECH05 (2) WATER TECHNOLOGY

Objectives: To make the students aware about the issues involved in water and water quality aspects and also to learn about physical, chemical and biological techniques available for managing water quality.

SECTION A

UNIT I: Conventional water and waste water treatment methods, their capabilities and limitations, Need for advanced treatment of water and waste water. **(7)**

UNIT II: Advanced water treatment- Iron and manganese removal, colour and odour removal, activated carbon treatment, carbonate balance for corrosion control, ion exchange, electro-dialysis, reverse osmosis and modern methods and flouride management. **(8)**

UNIT III: Advanced waste water treatment- Nutrient control in effluents, Nitrogen and phosphorus removal methods including biological methods, Methods for the removal of heavy metals, oil and refractory organics. **(7)**

SECTION B

UNIT IV: Microsreening, ultra-filtration, centrifugation and other advanced physical methods- aerobic digestion, anaerobic filtration, rotating biological contractor, novel methods of aeration etc. **(7)**

UNIT V: Combined physico-chemical and biological processes, Activated carbon treatment, chlorination of waste water, Pure oxygen systems. **(8)**

UNIT VI: Filtration for high quality effluents, multistage treatment systems, Land treatment and other resources recovery systems. **(8)**

Text Books:

1. Introduction to Environmental Engineering, By P.A. Veslind, PWS Publishing Company, Boston, 1997
2. Activated Sludge Process: Theory and Practices, By N.F Grey, Oxford University Press, 1990.

Reference Books:

1. Wastewater Treatment and disposal, By S.J. Arceivalla, Marcel Dekker, 1981.
2. Wastewater Treatment Plant Planning, Design and Operation, By S.R. Quasim, Holt, Rinehart & Winston N.Y.

6CH06 CHEMICAL ENGINEERING OPERATION-II LAB (MASS TRANSFER-I)

List of Experiments:

1. To calculate the diffusivity of vapors of volatile liquid into air by Stefan's tube. (Winklemann's Experiment)
2. To find coefficient of mass transfer of naphthalene ball in stagnant air.
3. To find yield of crystallization with and without seeding.
4. To establish Freundlich and Langmuir isotherm.
5. To determine liquid diffusion coefficient of solute diffusing in water.
6. To determine the critical moisture content of given material.
7. To measure humidity of air from humidifier.
8. To study unsteady state adsorption.
9. To compare the mass transfer in stagnant infinite medium in laminar and turbulent flow.
10. To determine gas film mass transfer coefficient by wetted column for G/L system.
11. Use of humidity or psychometric chart.
12. To compare the mass transfer coefficient for different liquids from free surface by evaporation.
13. Separation of NaNO3 by fractional crystallization.
14. To study the efficiency of tray drier.

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

6CH07 COMPUTER PROGRAMMING & APPLICATIONS - LAB

List of Experiments:

1. Design an algorithm, draw a flow chart and write program to perform addition, subtraction, multiplication and division of two numbers by taking two values from users.
2. Algorithm quadratic equation (for root of).
3. Program for solving ordinary differential equation with initial value of Euler's method.
4. To find value of unknown of simultaneous by Gauss elimination method.

5. To find roots of equation using Bisection method.
6. Algorithm for Regula-Falsi method.
7. Find the roots of equation by Newton-Raphsons method.
8. Program for modified Newton-Raphson method.
9. Design algorithm for regression.
10. Algorithm for print the grades of students using if-else-if statement.
11. Design algorithm and flow chart for Runga-Kutta method.
12. Design algorithm and flow chart to find greatest and smallest element.

Note: The students should perform minimum EIGHT experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

6CH08 MINOR PROJECT

The students in a group of not more than four members have to work on a topic which is experimental and analytical in the area of **Chemical Engineering**. Each project shall have a guide. On completion of the work, a project report should be prepared and submitted to the Department. The project work and the report will be evaluated by an internal assessment committee for 25 marks. The university examination for 25 marks will be a Viva-Voce examination conducted by a committee of one external examiner and one internal examiner /Guide appointed by the University.

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SYLLABUS PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN B TECH POLYMER (PLASTIC) TECHNOLOGY SEMESTER - V (CREDIT & GRADE SYSTEM)

5PP01 HEAT TRANSFER

OBJECTIVE:
To introduce the concepts of heat transfer to enable the students to design components subjected to thermal loading.

SECTION A

Unit I: Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension. Fourier's law. Heat transfer through plane, cylindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design & operation, introduction to unsteady state heat transfer.

Unit II : Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection. Dimensional analysis applied to heat transfer. Dittus-Boelter equation. Limitations and application.

Unit III : Heat transfer by parallel and counter current flow, concept of log mean temperature difference, rate of heat transfer. Heat transfer by film wise and drop wise condensation in horizontal & vertical tube.

SECTION B

Unit IV : Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers.

Unit V : Boiling & Evaporators: Theory of boiling. Classification, types and field applications of evaporators. Single and multiple effect evaporators. Heat transfer through submerged coils, jacketed vessels.

Unit VI: Heat transfer by radiation, concept of black body, Kirchhoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidized beds.

Text Book:
1) Heat Transfer: Sukhatme
2) Chemical Engg.: Coulson & Richardson, Vol. I (ELBS, Pergamon Press, 1970)

Reference Books:

1) Heat Trasnfer: Me Adams
2) Basic Heat Transfer: Necati Orisik, McGraw Hill Co., Kogakusha-
3) Heat Transfer: J.P.Hokman, McGraw Hill Co., Kogakusha.
4) Unit Operations of Chemical Engg.: McCab and Smith.
5) Introduction to Chemical Engg.: Bedger and Banchero.
6) Heat Transfer: Gebhart, McGraw Hill, 2nd edition, 1979.

5PP02 POLYMER MATERIALS

OBJECTIVE:

To understand the materials, properties, production method along with the application of various polymer material

SECTION A

Unit I : History and development of polymer materials. Basic raw materials for polymer and their availability, Production, Properties and application of Polyolefin's such as HDPE, LDPE, LLDPE, & PP

UNIT II: Production, properties and application of PVC, characteristics & compounding of PVC, Natural and modified natural polymers such as cellulose, cellulose nitrate. Cellulose Acetate. CAB polymers their manufacture, properties & applications.

Unit III : Production, Properties & applications of Acrylic Plastics such as PMMA & Styrene based Polymers such as PS, HIPS, SAN, EPS, & MBS

SECTION B

Unit IV: Production, Properties & applications of engineering plastics such as Polycarbonate, PPO, PPS, ABS, PET, Polyamide, polyimide's, Fluro Polymers. Acetal resins.

Unit V : Thermoset Technology, production, properties & applications of Phenolics,Urea, and Melamine resins. Chemistry and Molding powder preparation,

Unit VI: Properties & application of Cellyl and Epoxy resins, unsaturated Polyesters. Chemistry and Molding powder preparation, Polyurethane resins

Text Books:

1) Plastic Materials : J.A.Brydson
2) Polymer Science & Technology of Plastics & Rubbers : P.Ghosh

Reference Book:

1) Encyclopedia of PVC, Vol. I, II & III : L.I.Nass.
2) Manufacture of Plastics : Maya Smith.
3) Vinyl & Diene Monomers Part I & II : E.C.Leonard.

4) Fibers Fillers Plastics & Rubbers : W.J.Roff.
5) Plastics Materials Proof & Application (1, 2, 3) : Birley.
6) Hand Book of Plastics & Elastomers : Harmansen.
7) Plastic Materials Handbook : Athalye.
8) Handbook of Plastics Materials & Technology : Rubin.

5PP03 ENGINEERING PLASTICS AND SPECIALTY POLYMER

Objective

To familiarize the students with specific class of advanced polymers defined on the basis of their specific properties. This paper will emphasize on the study of processing requirements for specialty polymers, engineering and specialty application of these materials in various vital fields like high performance applications, biomedical, aerospace engineering, electronics and other areas and manufacture.

SECTION A

Unit I : **Liquid Crystalline Polymers (LCPs):** Concept of liquid crystalline (LC) phase, liquid crystalline polymers and their classification. Theories of liquid crystallinity, characteristics of LC state and LCPs, synthesis, structure property relationship, rheology of liquid crystalline polymers, blends of LCPs, self reinforced composites, applications of LCPs.

Unit II: **Conducting Polymers** Classification of Conducting Polymers, Theory of conduction, semi conductors and conducting polymers, band theory, requirements for polymer to work as conductor, types of conducting polymers - intrinsic and extrinsic, doping of polymeric systems, synthesis, processing and testing of conducting polymers, applications and recent advances.

Unit III: **Heat Resistant Polymers:** Requirements for heat resistance, determination of heat resistance, synthesis, structure-property relationships, applications of heat resistant polymers like polyamides, polyamides and its derivatives, engineering plastic blends.

SECTION B

Unit IV : **Photosensitive Polymers and Polymers as Coating Additives** Photosensitive polymers - synthesis, curing reactions, applications in various fields. Membranes, their types, methods of casting and their applications. Water soluble polymers, Polymer as coating additives - types, synthesis, requirements for polymer to work as coating additives and applications

Unit V : **Biopolymers and Biomaterials :** Biopolymers - Study of natural biopolymers and synthetic biopolymers and their applications like bioassays, biocatalysts, etc., need of biomaterials and biopolymers, biodegradation, environmental impact, biomaterials and their medical applications, orthopedic applications, rehabilitation aids, etc., testing procedures (ASTM). Biodegradable polymers

Unit VI : **Polymers in Miscellaneous Specialty Applications** Polymers in agricultural applications: Polymers in automobile, aerospace, light emitting polymers, polymers for ion exchange resins and membranes.

Text Books:

1) Recent Advances in Liquid Crystalline Polymers; L. Lawrence Chapoy, Ed. Elsevier Science, New York, 1985
2) Engineering Polymers; R.W. Dyson, Chapman and Hall, New York, 1990

Reference books:

1. Polymers for High Technology Electronics and Photonics; M.J. Bowden and S.R. Tumer, Amer. Chem. Soc., 1987
2. Additive for coatings, John Bieleman, Wiley-VCH, 2000
3. Additives in water borne coatings, Gerry Davison, Bruce Lane, Royal society of Chemistry, 2003
4. Encyclopedia of Polymer science and Engineering Vol.1-17, Jacqueline I. Kroschwitz, 2007.

5PP04 INSTRUMENTATION AND CONTROL

OBJECTIVE:

To understand the concepts of different instrument which are used in Industries also to enable the students to design components during the process.

SECTION A

Unit I : Measuring Instruments: Qualities of measurement, elements of instrument, static & dynamic characteristics, measurements of temperature and levels.

Unit II : Measurement of pressure, vacuum, humidity & pH in process industry.

Unit III : Methods for composition analysis. Principle and techniques of instruments for composition analysis in process industry, such as chromatography, spectroscopy, refractrometry etc.

SECTION B

Unit IV: Flow measuring instruments: Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.

Unit V: Introduction to Simple system analysis: Laplace Transformation. Block diagrams, linearization. First and higher order system.

Unit VI: Frequency response, distributed parameter system, dead time. Feed back control, servo and regulator control. Time domain closed loop responses, closed loop frequency response.

Text Books :

1. Industrial Instrumentation: Eckman, Wiley Eastern
2. Instrumental Methods of Chemical Analysis : Erwing, McGraw Hill.

BOOKS RECOMMENDED:

1) Instrumentation & Process Measurements : W.Bottom, Orient Longman.
2) Industrial Control & Instrumentation : W.Bottom, Orient Longman.
3) Outlines of Chemical Instrumentation & Process Control : A. Suryanarayan, Khanna Pub., New Delhi.

FREE ELECTIVE – I
5FEPP05 (1) POLYMER SCIENCE & TECHNOLOGY

OBJECTIVE:

To understand the concepts polymer Technology.

UNIT I : History of Polymer, Introduction to polymers, classification & types of polymers. Nomenclature. Thermoplastics and thermosets. Linear, branches an cross linked polymer Block and graft copolymer. Avg. Mol. wt, Number Avg. Mol. Wt., degree of polymerization, poly dispersity, and mol. Wt. distribution, size of polymer molecules, Chemistry of Polymerization

Unit II : History and development of polymer materials. Basic raw & materials for polymer and their availability, Production, Properties and application of Polyolefin's, Vinyl halides, PVC

Unit III: Polymer processing techniques: Injection molding, compression molding, transfer molding

Section II

Unit IV : Polymer Processing Techniques: Extrusion molding, Blow molding, Thermoforming.Etc.

Unit: V: Polymer Degradation and recycling: Types of degradation, Thermal degradation, Mechanical Degradation, Degradation by ultrasonic waves, photo degradation, Biodegradation.

Unit VI: Polymers in agricultural applications: green houses, mulches, control release of agricultural chemicals, seed coatings, etc., polymers in construction and building applications, polymer concrete, polymeric materials used in communication applications, polymer composites in aerospace and other light weight applications, polymers in cosmetics and food applications,

Text Book:

1. Plastic Materials : J.A.Brydson
2. Polymer Science: V.R. Gowariker

Reference Book:

1) Manufacture of Plastics: Maya Smith.
2) Fibers Fillers Plastics & Rubbers: W.J.Roff.
3) Plastics Materials Proof & Application (1, 2, 3) : Birley.
4) Hand Book of Plastics & Elastomers : Harmansen.
5) Plastic Materials Handbook: Athalye.
6) Handbook of Plastics Materials & Technology : Rubin.
7) Polymer Science & Technology of Plastics & Rubbers : P.Ghosh.

FREE ELCECTIVE - I

5FEPP05 (2) RUBBER TECHNOLOGY:

Objective

This course the details pertaining to raw materials, formulations, processing, testing, applications have been presented. A sound understanding of these polymeric materials would equip the students for careers in rubber industry.

SECTION -A

Unit I : Introduction of elastomer , selection criteria for elastomers for intended application origin of rubber , latex technology, compounding, manufacturing techniques such as Dipping and washing , coagulation, slush molding and rotational casting, latex foam rubber ,properties of raw natural rubber , special types of rubber

Unit II : Mastication and compounding behavior , Principles of compounding, mechanism of reinforcement , method of incorporation , reinforcement phenomenon in unvulcanisate system, reinforcement phenomenon in vulcanisates, Requirements of textile for reinforcements of rubber products, machinery and methods used for compounding

Unit III : Materials for compounding and reinforcement, chemicals and additives used in rubber compounding , need for addition, Selection criteria and properties of carbon black, non black fillers, fibrous fillers , plasticizers, softeners, extenders , special types of additives, anti aging , antioxidants ,antiozonants , anti static agents, blowing agents, colorants, processing aids, flame retardants

SECTION -B

Unit IV: Manufacturing process sequence in rubber industry such as mixing, forming and vulcanization, machinery used for different operation, internal mixers, Processing of rubbers by Extrusion process, calendaring process, Injection molding Compression molding, finishing of rubber compounds

Unit V : Tyre technology – Tyre components , processing of elastomer for pneumatic tyre and tube , its design consideration and aspects , tyre building process , preparation of raw tyre for vulcanization, molding and vulcanization , instrumentation and control system

Unit VI: Different test methods for determination of free sulfur, ash content, moisture contents Test methods for hardness, abrasion resistance, wear resistance, tear resistance, weathering resistance, heat resistance, compression set, and tensile strength

Text book:

1. Rubber Technology Edited by Maurice Morton Kluwer, Academic Publishers, 2010

2. Rubber Technology and Manufacture by C M Blow, Butterworth-Heinmann, 2nd Edition, 1982

References books:

1. Rubber Compounding Chemistry and Application by Bredan Rodgers Publisher: CRC Press; 1 edition, 2004
2. Rubber Compounding by Fred W Barlow, Mercel Dekker Inc, 1993
3. The Physics of Rubber Elasticity by L. R. G. Treloar, Publishers: Oxford University Press Inc, 2005
4. Natural Rubber Science and Technology by A. D. Roberts, Oxford Science Publication, 1988
5. Engineering with Rubber: How to design Rubber components by Alan N Gent Publishers: HANSER PUBLISHERS, 2001
6. Practical Rubber Compounding and Processing by B. W. Evans Publishers: Applied Science Publication, 1981
7. Rubber to Metal Bonding by B. G. Crowther, RAPRA TECHNOLOGIES , 1996
8. Advances in the bonding of rubber to various substrates by RAPRA TECHNOLOGIES (2001)
9. Rubber Handbook by Babbit (Author) , R T Vanderbilt Publishers, 13th edition,1990

5PP06 COMMUNICATION SKILLS:

Unit I : Comprehension over an unseen passage. Comprehension - A - word study :- Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage. Comprehension - B - Structure study :- Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc. Active and passive forms, negative and interrogative, punctuation and capitalization. Unit

UNIT II : Theoretical background - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content. Non-verbal communication, types of graphics and pictoral devices. (10 Hours)

UNIT III: Specific formats for written communication like – business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for dayto day written communication like applications, notices, minutes, quotations, orders, enquiries etc. Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews. Methodology of conduction of meetings, seminars, symposia, conference and workshop.

BOOKS RECOMMENDED :

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.

2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.

3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.

4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

5PP07 HEAT TRANSFER – Lab

List of Practicals:

1. To study the temperature distribution, heat transfer and effectiveness in parallel flow heat exchanger.
2. To study the temperature distribution, heat transfer and effectiveness in counter current flow heat exchanger.
3. To study heat transfer through lagged pipe.
4. To determine thermal conductivity of insulating powder
5. To determine the emissivity by using the emissivity measuring apparatus.
6. To determine thermal conductivity by two slab guarded hot plate method.
7. To study heat transfer through composite wall.
8. To study Stefan Boltzman’s constant
9. To study temp distribution, heat transfer in forced convection.
10. To study temp distribution, heat transfer in natural convection.
11. To study temp distribution, heat transfer in rectangular fin.
12. To study temp distribution, heat transfer in horizontal condenser.
13. To study temp distribution, heat transfer in vertical condenser.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

5PP08 POLYMER MATERIAL - Lab

List of Practicals:

1. To determine tensile strength of a given plastic material
2. To determine percentage elongation
3. To determine cross breaking or flexural strength of a given plastic specimen
4. To determine static & dynamic coefficient of friction of plastic film.
5. To determine vicat softening temperature of plastic specimen
6. To determine dart Impact strength of plastic sheet or film with the help of dart Impact tester.
7. To determine melt flow Index by extension plastometer.
8. To determine Izod Impact strength of given plastic material.
9. To determine temperature deflection under load of given plastic specimen
10. To determine haze percentage of specimen by using Haze Meter.
11. To determine ESCR of given plastic specimen with environmental stress cracking resistance.
12. To determine apparent bulk density and funnel flow of given material.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

5PP09 INSTRUMENTATION & CONTROL - Lab

List of Practicals:

1. To determine refractive index for mixtures and also to calculate molar refraction of liquid mixture and prepare plot of refractive index Vs Compositions using Abb's refractometer
2. To calibrate pressure gauge using dead weight pressure gauge tester.
3. To verify weather the temperature switch is accurate within the specified ranges and to calibrate thermometer against temperature switch.
4. To find amount of NaOH require for neutralization of given amount of HCL Using a PH Meter
5. To determine response of the bare measuring thermometer for
   i) positive step change
   ii) Negative step change.
6. To calibrate rotameter.
7. To study the response of single tank
8. To determine gas flow rate by gas flow meter and to compare the reading other sources.
9. To study thermocouple.
10. To find amount of sodium hydroxide required. Exactly to neutralize a known amount of hydrochloric acid using a khohlrauseh conductivity bridge and hence to verify the same titrate value with volume titration.
11. To measure wind velocity using van anemometer.
12. To measure the humidity (absolute, relative) using psychomotor.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

5PP10 COMMUNICATION SKILLS LABORATORY

Objective:

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be accessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for

problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter

6PP01 CHEMICAL ENGG. OPERATION – II
(Mass Transfer)

SECTION A

Unit I : Introduction to mass transfer: Various industrially important mass transfer operations, their classification. Fundamental of mass transfer, flux, driving force, resistance, rate of mass transfer, co-current, cross current, counter current operations, Batch and continuous operations.

DIFFUSION: Molecular diffusion, Fick's law, equimolecular counter current diffusion, unicomponent diffusion in stagnant medium: stefen's law, Predication of diffusivities based on physical properties, Experimental determination of gas diffusivities winklemanns experiment. Liquid diffusivities. Gas diffusion through polymers, factors affecting gas permeability of polymers.

Unit II : Interphase mass transfer: Concept of equilibrium curves, mechanism of mass transfer. Two film theory and penetration theory. Mass transfer coefficient, relation between individual and over all mass transfer coefficient, conceptof controlling film resistance. Studies in turbulent mass transfer, dimensionless groups such as sherwood No., schimdt No., stanton no., grashoffho, JD factor.

Unit III: Flow through packed bed limiting flow rates, loading and flooding, fluidisedbed, principle of gas absorption, absorption factor, stripping factor material balance in absorption column. Equipments for gas absorption, scrubbers.

SECTION B

Unit IV & V: Distillation - Vapour liquid equilibria, Raoult's laws, & Henry's law, relative volatility, methods of distillation.-Differential distillation, (Rayleigh's equation), flash distillation, Description of fractionating column, McCabe Thiele method for calculating number of plates, Effects of reflux ratio on number of plates, fenske's equation, murphree plate efficiency and overall efficiency. Introduction of Azeotropic and steam distillation. (Detailed design for isotropic and steam distillation is not expected)

Unit VI: Humidification and Drying: Basic definitions, psychometric chart, theory of humidification, equipments for humidification, cooling tower. Theory of drying, rate of drying, equipments for batch and continuous drying.

Text Books:
1. Unit Operation of Chemical Engg.: McCabe and Smith
2. Chemical Engineering Vol. 1: Coulson and Richardson.

Reference Books:
1) Principles of Unit Operation: A.S.Foust.
2) Unit Operation: C.G.Brown
3) Introduction to Chemical Engineering: Badger and Banchero.
4) Mass Transfer Operation: R.E.Trebal.
5) Momentum Transfer Operation: S.K.Gupta
6) Physical Chemistry of Polymers: A. Tager.
7) Fundamentals of Polymer: Anil Kumar and R.K.Gupta.

6PP02 ELASTOMER TECHNOLOGY

SECTION A

Unit I : Introduction of Elastomer, introduction of rubber , basic raw materials , natural rubber, other forms of natural rubber, properties of raw natural rubber, storage hardening and crystallization of natural rubber , mastication and compounding behavior , Manufacturing process sequence in rubber industry such as mixing, forming and vulcanization.

Unit II: Vulcanization of rubbers , vulcanization by sulfur, peroxides and by other methods , non sulfur vulcanization, kinetics of vulcanization , chemical reaction, Factors affecting rate of vulcanization , vulcanization conditions , techniques of vulcanization.

Unit III: Processing of Elastomer for pneumatic tire and tube its design aspects and consideration, tyre building process, difrent tyre components , Retreading of tyres Raw material , compounding , processing , properties and application of SBR, butyl rubber, Nitril Rubber , EPM and EPDM Rubber , polysulphides.

SECTION B

Unit IV: Additives in plastics & its requirements, types of filler and reinforcement, choice of fillers and properties. Theory of plasticizers. Types and requirement of plasticizers. Selection and properties of lubricants.

Unit V : Selection and properties of other additives such as Antioxidant Antiozonates. Antistatic agents. UV stabilizers. Ant blocking agent, Processing aids, colorants', Foaming agents, Toughening agents and Flame retardants.

Unit VI: Introduction to Adhesives, its classification & requirements. Formulation and application of adhesives in various fields, Manufacture and testing of adhesives. Recent advances in adhesive technology.

Text Books :
1. Introduction to Rubber Technology: Morris Morton
2. Plastics Materials: H.A.Brydson

Reference Books:
1) Rubber Technology & Mfg.: C.M.Blow
2) Science and Technology of Rubber: E.R.Eircich
3) Polymer Processes: Schidknechi
4) Rubber Materials & their Compounds: Brydson
5) Plastics Additives, An Introduction Guide: Flick
6) PVC Technology: Titow
7) H.B. of Plastics & Elastomers: Harper
8) Plastics Additives Handbook Illrd Edn.: Gachter
9) Adhesive Technology Handbook: Landrock
10) H.B. of Adhesives: Skiest
11) Fundamental of Adhesion: Lee

6PP03 COMPUTER PROGRAMMING AND APPLICATIONS

Note: Application of the following techniques for problems of interest in chemical engineering, writing and testing of programs written in C Language.

SECTION A

Unit I : Numerical solution of first order differential equations with initial condition, Euler's method, Runge-Kutta method.

Unit II: Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method.

Unit III: Roots of algebric and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental and algebric equations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems.

SECTION B

Unit IV : Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial.

Unit V : Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods.

Unit VI : Computer programming in modular form, use of subroutine libraries, Block diagrams of preliminary aids in programming, capacity optimization.

TEXT BOOKS:

1. Digital Computation for Chemical Engineering by Leon Lapidas, McGraw
2. Numerical methods and programming by S.S. Shastry

6PP04 POLYMER ENGINEERING THERMODYNAMICS

Unit I : Review of Fundamental Concepts: System, surrounding, boundary, thermodynamic processes, thermodynamic Junctions and variables. Extensive and intensive properties, Definitions and properties of state function. Concepts of enthalpy and free energy. Coefficient of thermal expansiona, compressibility coefficient b relation between a and b. Relation between Cp and Cv. Brier definitions of First, Second and Third law of Thermodynamics. State of equilibrium, Free energy functions and their properties. Variation of free energy with pressure at constant temperature, temperature dependence of free energy. Thermodynamic equilibrium and free energy functions, criteria for equilibria at Constant T and V, Criteria for equilibria at constant T and P.

Unit II: One Component System: Physical equilibria involving phase transitions, the Clapeyronequation, application of Clapeyron equation, The Clasius - Clapeyron equation. System of Variable Composition: Partial molar quantities, determination of partial molar quantities, Gibbs- Duhem equation, Chemical potential, Chemical potential and other thermodynamic functions, effect of temperature and pressure on chemical potential of a pure substance, chemical potential in an ideal gas mixture.

Unit III : Thermodynamic functions of mixing: Free energy of mixing, entropy of mixing, volume of mixing, enthalpy of mixing. Properties of Liquid solutions: Ideal solutions and Raoult's law. Vapour-Liquid equilibria, Chemical potential in an ideal liquid solution, mixing properties of ideal solution, solubility behaviour of ideal solution.

Colligative properties:

Lowering of vapour pressure, elevation of boiling point, freezing point depression, Osmosis and osmotic pressure, Determination of molecular weight of *non* volatile solute, Ebulliometric constant.

SECTION B

Unit IV & V : Polymer - Low molecular liquid systems: &Ideal, Non-ideal, Regular solutions, True solutions of Unit Polymers. Dissolution and swelling of polymers, unlimited swelling, limited swelling, factors affecting dissolution and swelling of polymers. Thermodynamics of polymer solution, Basic concepts of Flory - Huggins theory, criteria for polymer solubility, solubility parameter, Phase equilibrium of polymer - solvent system, Binary systems, LCST, UCST. Gels of polymers.

Unit VI : Chemical Equilibria Formulation of equilibrium law, equilibrium law for ideal gases, Free energy change in chemical reaction, chemical affinity and thermodynamic functions, Equilibrium constant, Relation between Kp, Kc and Kx. Variation of equilibrium constant with temperature, variation of equilibrium constant with pressure. Equilibria for condensation polymerization, Equilibria of radical polymerization.

Text Books:

1. An Introduction to Chemical Thermodynamics - Rastogi & Mishra, VikasPub.
2. Physical Chemistry of Polymer: A.Tager, Mir Pub.

LIST OF BOOKS:

1) An Introduction to Chemical Engg. Thermodynamics - J.M.Smith & H.C.Vanhess, Kogakusha, 1976.
2) The Principle of Chemical Equilibria and Applications in Chemistry and Chemical Engg. - K.Denbig, Cambridge Uni. Press, ELBS.
3) Fundamentals of Polymer Science and Engineering: Anilkumar and S.K.Gupta.
4) Text Book of Polymer Science: Billimeyar.
5) Polymer Chemistry: An Introduction: Seymour.
6) Polymer Science & Tech. of Plastics & Rubbers: P.Ghosh.

6FEPP05 FREE ELECTIVE – II
(1) PACKAGING TECHNOLOGY

Objective

Plastic material offer unique advantage in the area of packaging from aesthetics and functional point of view. Objective of this course is to introduce the students to the emerging area of plastic packaging technology.

SECTION I

Unit I : **Introduction** Need for packaging, packaging done by nature, purpose of packaging, types of packaging Packaging materials: glass, metal, wood, plastics etc, and complete detail of material selection criteria.

Unit II : **Packaging Engineering** New product development, market, self life, quality assurance, logistic, graphic design, regulation, temperature evidence packaging, child resistance packaging, quality management system, verification & validation protocols, life cycle assessment, waste hierarchy, importance of 3 R (Reduce, reuse & recycle).

Unit III : **Package Design Approach** Product–packaging relationship, product–package characteristics, compatibility factors, product type vs packaging requirements, product characteristics– physical state, centre of gravity, size / weight, volume. Product characteristics– chemical: effect of gases, moisture, atmospheric gases, product characteristics – biological: sensitivity to microbial factors. Product characteristics – physico chemicals: effect of moisture, vapor, oxygen & other gases

SECTION II

Unit IV: **Packaging Material Characteristics:** Packaging material properties – physical: influence of molecular / fiber directions, tensile, breaking load, tension, tear, torsion, puncture, burst, packaging, material Properties – chemical: pH, chloride / sulphate content, imbedded and un-reacted chemicals, packaging material properties – biological: sensitivity to micro organisms, packaging material properties – physic chemical: absorption & diffusion of moisture and gases – barrier properties.

Unit V: **Packaging Material Evaluation** Physical & mechanical properties: weight, dimensions, strength properties, stiffness, tear, tensile and others, chemical properties: alkalinity, acidity, resistance biological properties, sensitivity to microbes, chemicals, presence of chloride, sulphate, lignin, ash, flammability, physiological properties – odor / flavors.

Unit VI : **Packaging Machines** Bottle filling lines which includes bottle washing, sterilization, filling, screw capping/crown corking, induction sealing, labeling etc., form fill seal machines: types (vertical & horizontal), flow rap machine, retort machine, tetra packs, wooden packaging, miscellaneous packaging technique, bag in box, child resistance pack, packaging in canes etc, biodegradable and ecofriendly packaging, advantages and disadvantages, packaging used for export, advancements and developments and application.

Text Books:

1. Packaging Handbook– A.S. Athalye, Tata McGraw Hill, New Delhi, 1992
2. Fundamentals of Packaging Technology – F.A. Paine (Blackie & Sons Publication) 1967

Reference Books:

1. Packaging, Materials and Containers – F.A. Paine (Blackie & Sons Publication), 1967.
2. Plastics in Packaging – A.S. Athalye, Tata McGraw Hill, New Delhi, 1992
3. 5.. Plastic Packaging- Susan E.M. Selke (Hanser Gardner Publication), 2004
4. Plastics Packaging – Properties, Processing, And Applications.[2nd Edition] By Susan E. M. Selke, John Culter, 2010.
5. Plastics Materials for Packaging By Barnetson [Rapra Publications], 1996
6. Understanding Plastics Packaging Technology By Susan E. M. Selke, John Culter,
7. Rigid Plastics Packaging – Materials, Processes And Applications By F. Hannay [Rapra Publications], 2002.

6FEPP05 COMPOSITE TECHNOLOGY

Unit I : Introduction to Composites, Classification of composites (on the basis of matrix materials-polymer, metal, wood, ceramic etc), Classification of Composites (on the basis of reinforcements types- particulate, sheets etc) , Fundamentals of Composites (matrix, reinforcement and interphase) and their role in formation and working of composites, Structural Types of reinforcements(particulate, sheets, whiskers etc) , Selection Criteria for material selection and composites formation, Factors affecting composites (Wet ability , Bonding, Compatibility ratio, surface tension etc.)

Unit II: Manufacturing, Chemistry, Properties and Application of various materials used as matrix (polymer-thermoplastic, thermosets, Elastomer, ceramics etc) Mechanical, thermal, electrical, environmental and viscoelastic etc properties in relation to matrix and processing.

Unit III : Manufacturing, Chemistry, properties and application of various materials used as reinforcements (Natural fibers, synthetic fibers - glass fibers, aramid fibers etc, whiskers, sheets, wovens etc.), Types of Fiber orientations- role and properties. Role and behavior of interphase in composites. Mechanical, thermal, electrical, environmental and viscoelastic etc properties in relation to reinforcements and processing.

Unit IV : Additives used in composites- properties and functions and examples (fillers, coupling agents, antioxidants, anti-ozonants, UV and light stabilizers, anti-static agents, dyes and pigments etc) Processing techniques for Composites- Open Moulding Techniques (Hand layup, Spray layup, Vacuum bag Molding, Encapsulation etc.

Unit V : Processing techniques for Composites- Close Molding Techniques (Filament winding, Pultrusion, Resin transfer molding etc). Advanced Composites, Advanced materials used for composites. Modifications and Advancements of advanced Composites over conventional composites.

Unit VI: Designing aspects of Composites with relation to processing (designing for hand layup & spray layup). Detail application wise study of different composite examples in diffenet fields- Automobile, Aerospace, electrical and electronics, Chemical Industries, Civil and Construction Industry and Textile Industry etc.

Text Books:

1. Polymer Engg. Composites, M.O. W.R.Richardson applied science London 1976.
2. SPI Handbook of Tech. and Engg. of Reinforcements for Plastics and Composites, J.G.Mohr.S.S.Oleesky, G.D.Shook, L.S.Meyer, Van Nostrand Renhold Co., New York 1973.

References Books:

1. Polymer Composite by Margolies.
2. Encyclopedia of composites by Nass
3. Composite material By S.P.Agrwal

6PP06 CHEMICAL ENGG. OPERATION –II (MASS TRANSFER) – LAB

List of Experiments:

1) To calculate diffusivity of vapours of volatile liquid into air by stefan’s tube.
2) To determine the liquid diffusion of salt diffusing in water.
3) To compare the mass transfer coefficient for different liquids from free surface.
4) To prepare the b.p. diagram and plot x-y data. On equilibrium diagram.
5) To determine gas film mass transfer coefficient by wetted ball conlumn
6) To find mass transfer coefficient of napthalene balls in air.
7) Verification of rayleigh’s equation for different (batch) distrillation.
8) To determine vaporization efficiency and thermal efficiency in case of steam distillation.
9) To determine critical moisture content of a given material.
10) To determine gas permeability of plastic film.

6PP07 ELASTOMER TECHNOLOGY - LAB

List of Experiments:

1. To determine of plastic / Films.
2. To find out point and softening range of polymer
3. To determine the resistance of liquid(swelling) of rubber sample
4. To determine tensile strength of a given rubber material before and after emulsion
5. To determine percentage elongation of a given rubber sample before and after emulsion
6. To determine flex strength of a given plastic material
7. To determine specific gravity of a given rubber sample
8. To study abrasion resistance of a given rubber sample
9. To determine moisture content and ash content of given sample
10. To determine the compressive strength of a given rubber sample
11. To determine the bursting strength of a different given sample
12. To evaluate adhesion between plies of fabric bonded with rubber by dead load methd.
13. To determine dielectric strength of plastic
14. To study the plasticity of rubber sample by rapid plastometer.
15. Industrial report.

6PP08 COMPUTER PROGRAMMING & APPLICATION - LAB

List of Experiments:

1. Design an algorithm, draw a flow chart and write program to perform addition, subtraction, multiplication and division of two numbers by taking two values from users.

2. Algorithm quadratic equation (for root of).
3. Program for solving ordinary differential equation with initial value of Euler's method.
4. To find value of unknown of simultaneous by Gauss elimination method.
5. To find roots of equation using Bisection method.
6. Algorithm for Regula-Falsi method.
7. Find the roots of equation by Newton-Raphsons method.
8. Program for modified Newton-Raphson method.
9. Design algorithm for regression.
10. Algorithm for print the grades of students using if-else-if statement.
11. Design algorithm and flow chart for Runga-Kutta method.
12. Design algorithm and flow chart to find greatest and smallest element.

Note: The students should perform minimum 8 experiments from the list to complete the term. All experiments in this list shall be available in the laboratory. Additional experiments relevant to the syllabus may be added to the main list.

6PP09 MINOR PROJECT

The students in a group of not more than four members have to work on a topic which is experimental and analytical in the area of **POLYMER TECHNOLOGY**. Each project shall have a guide. On completion of the work, a project report should be prepared and submitted to the Department. The project work and the report will be evaluated by an internal assessment

committee for 25 marks. The university examination for 25 marks will be a Viva-Voce examination conducted by a committee of one external examiner and one internal examiner /Guide appointed by the University.

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SYLLABUS PRESCRIBED
FOR BACHELOR OF TECHNOLOGY
(CHEMICAL TECHNOLOGY)
FOOD TECHNOLOGY, PULP & PAPER TECHNOLOGY, OIL & PAINT TECHNOLOGY AND PETROCHEMICAL TECHNOLOGY
SEMESTER PATTERN
FIFTH SEMESTER
5CT 01 HEAT TRANSFER

SECTION-A

Unit I : Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension.

Fourier's law.

Heat transfer through plane, cyclindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design & operation, introduction to unsteady state heat transfer.

Unit II : Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection dimensional analysis applied to heat transfer. Dittus-Boelter equation. Limitations and application.

Unit III : Heat transfer by parallel and counter current flow, concept of log mean tempeature difference, rate of heat transfer. Heat transfer by film wise and dropwise condensation in horizontal & vertical tube.

SECTION-B

Unit IV : Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers.

Unit V : Boiling & Evaporators : Classification of types and field applications of evaporators single and multiple effect evaporators.

Heat transfer through submerged coils, jacketted vessels.

Unit VI : Heat transfer by radiation, concept of black body, Kirchoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidised beds.

Recent developments in heat transfer.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED :

1)	Heat Trasnfer	:	Mc Adams
2)	Heat Transfer	:	Sukhatme
3)	Basic Heat Transfer	:	Necati Orisik, McGraw Hill Co., Kogakusha.
4)	Heat Transfer	:	J.P.Hokman, McGraw Hill Co., Kogakusha.
5)	Unit Operations of Chemical Engg.	:	McCab and Smith.
6)	Introduction to Chemical Engg.	:	Bedger and Banchero.
7)	Chemical Engg.	:	Coulson & Richardson, Vol. I (ELBS, Pergamon Press, Latest Edition)
8)	Heat Transfer	:	Gebhart, McGraw Hill, 2nd edition, Latest Edition
9)	Fundamentals of Engg.	:	R.C.Sachdeva, Wiley Eastern.
10)	Heat Transfer	:	R.C.Sachdeva.
11)	Heat & Mass Transfer	:	S.D.Dawande,Central Techno Pub., Nagpur

5CT 02 MECHANICAL OPERATIONS

SECTION - A

Unit I : Relevance of mechanical operations in industry.
I. Size reduction, stages of reduction, Equipments operating variables, laws of energies, energy requirements.
2 Screening: Screen analysis, particle size distribution.

Unit II : 1. Classification: Equal faIling particals, equipments, jigging, tabling.
2 Gravity settling, drag force, terminal settling velocity.
3. Sedimentation : Continous thickners.

Unit III : 1. Storage and handling of solids, transporation
2 Mixing, Mixers, agitation, types of equipments.

SECTION - B

UnitIV : 1. Filtration : Theory, operation, types, Flotation agents, flotation cells.
2. Filter Calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration - Constant pressure and constant rate and their equipments.

Unit V : 1. Centrifuges: Theory, Equipments, types and calculations.
2. Cyclones: Hydrocyclones, liquid scrubbers and electronic precipitators.

Unit VI : 1. Adsorption, theory, type and application, Langmuir's Freundlich's equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidised beds. Adsorption equilibria calculations for vapour, gas & liquid adsorption. Adsorption, operation such as single stage, multi stage, cross current & multistage counter current operation & equipments.
3. Recent developments in mechanical operation equipments.

PRACTICALS: based on above syllaubs.

BOOKS RECOMMENDED:

1. Momentum Transfer Operation:S.K.Gupta, TMC, Latest edition.
2 Unit Operations of Chemical Engineering: McCabe and Smith, TMC
3. Chemical Engineering Vol. I : Coulson & Richardson, Pergamon, Latest edition.
4. Principles of Unit Operations: A.S.Foust, et-al.
5. Unit Operations: C.G.Brown.
6. Introduction to Chemical Engg. : Beder & Bachero.
7. Mass Transfer Operations: R.E. Treybal
8. Mechanical Operations Vol-I : R.S.Hiremath & A.P.Kulkami.

5CT03 CHEMICAL ENGINEERING THERMODYNAMICS

SECTION-A

Unit I : Scope of thermodynamics and its importances to chemical Engineers, Basic concepts, extensive & intensive properties. state function & chemical systems. Definition, symbols & interrelation, concepts of Entropy, Enthalpy & internal energy. First law of thermodynamics, Equations of state, critical properties, Vander Wall's constants, Virial expansions, Redlich-Kwong equation, Beattie-Bridgeman equation.

Unit II : First law applied to thermodynamic processes & calculation of Workdone, free energy & heat changes. Maxwell relation equation, second law and third law of thermodynamics.
Thermodynamics relations based on second law. Relation between Cp & Cv, compressibility factor & coefficient of thermal expansion, concept of residual entropy & entropy of equilibrium.

Unit III : Partial molar and apparent molar properties, Gibbs Duhem equation, Chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties and thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws. Colligative properties. Ebulliometric constant. Determination of Molecular Weight of unknown chemical substances. Solubility law.

SECTION-B

Unit IV : Vapour liquid equilibrium, T-X-Y diagrams & X-Y diagram for ideal & non ideal system. Raoult's law and Henry's law. Deviations from Raoult's law. Comparision of ideal & non-ideal systems. Phase equilibria in non reaching multi-comonents, Binary, ternary systems. Graphical representation of L/L, L/S & G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Effect of temp. & pressure on ternary equilibrium, Phenol-Wafer systems. auiline-water-chlorobenzene systems.

Unit V : Statistical thermodynamics, thermodynamics probability, its relation with Entropy, partition function and its relation with termodynamics functions, the Boltzman distribution law, Distribution law for chemically reactive system. Thermodynamics charts & their uses. Searching of thermodynamics data.

Unit VI : Chemical Equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, Effect of temp. & pressure, Relation between Kp, Kc & Kv, Le-Chatelier's principle, Endo-Exothermic relations, Heterrogeneous equilibria, various methods of calculating free energy charge. Equilibrium conversions, case study of feasibility report for manufacture of industrial chemicals.

Practicals :- based on above syllabus.

Books Recommended :

1) An Introduction to Chemical Thermodynamics : R.P.Rastogi, R.R.Misra.
2) Chemical Engineering Process : Houghen-Watson.
3) Introduction to Chemical Engg. Thermodynamics : J.M.Smith, H.C.Vauhess
4) Thermodynamics for Chemical Engg. : H.C.Weber, J.P.Meissner
5) Engineering Thermodynamics : P.K.Nag.

6) Chemical Thermodynamic : M.R.Awode, Dattson, Nagpur.

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SPECIAL TECHNOLOGY-II
(RELATED TO CONCERNING TECHNOLOGY)
5FT04 (i) FOOD TECHNOLOGY-II
BIO-CHEMlSfRY AND NUTRITION

Organisation cell and cellular constituents. Introduction and classification of enzymes, specificity, enzymes Kinetics, activnetrs and inhabitors. Assay techniques, Isolation of enzymes trom sources and their application.

Bio-energetics, Digestion and metabolism of carbohydrates, proteins and fats. Photosynthesis, Nucleic acids and their functions.

Vitamins: Classification, sources, Chemistry, functions and deficiency symptoms. Assay of vitamins.

Minerals: Macro and micro-minerals, sources, functions and efficiency symptoms.

Nutrition: Functions of foods Energy, value of foods. BMR and its measurement, Energy requirement of individuals. Recommended dietary allowances of proteins, fats, carbohydrates, vitamins and minerals. Nutritional evaluation of proteins. Factors influencing nutritive value of foods. Loss of nutrients during processing. Enrichment and fortification of foods. Formulation of diets and foods for specific needs.

Antinutritional Factors of Foods :

Toxic compounds, enzyme inhabitors, alkaloids etc.

Techniques of biochemical analysis like spectrophotometry Chromatography, electro-phoresis Light and electro microscopy. Histochemical techniques, isotopic methods.

Recent Advances in the field.

Books Recommended :

1. Outlines of Biochemistry by E.E.Conn & P.K.Stump, Wiley Eastern Pvt.Ltd., New DeIhi.
2 Biochemistry of Foods by Eskin, N., A.M.Handerson, H.M. & Town End RJ., Academic Press, New York.
3. Cell Physiology by A.C.Giese, Sanders & Company, Toppan, Japan.
4. Integrated Biology by L.Hill, D.Bellamy, I Chester, Jones Chapman & Hall Ltd., London, EC4.
5. Principles of Enzymology for the Food Science by Whitaker J.R., Marcel Dekker, INC, New York.

6. Applied Nutrition by R.Rajalaxmi, Oxford & IBH Publishing Co., New York.
7. Heinz Handbook of Nutrition by Benzamin T. Burton, McGraw Hill . Book Company, New York.
8. Nutrition - An Integrated Approach by R.C.Pyke & M.L. Brown, Wiley Eastern Pvt.Ltd., New Delhi.
9. Hawk's Physiological Chemistry, Edited by Bernard L.Oser, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
10. Biochemistry: White A. Handler P., Smit E.L., McGraw Hill, Tokyo.
11. Text Book of Biochemistry : H.R.Mahler and E.H.Chordes, Harper & Row Publisher, New York.

SPECIAL TECHNOLOGY-ll (PRACTICAL)- LAB
5FT10 FOOD TECHNOLOGY
A.BIOCHEMISTRY

1. Estimation of carbohydrates and proteins by various methods.
2. Estimation of minerals, Phosphorus, Iron, Calcium.
3. Estimation of vitamin C and effect of heat.
4. Qualitative demostration of enzyme with salivary amylase.
5. Study of rate of enzyme reaction, effect of environmental factors on rate of enzyme action.
6. Detection of trypsin inhibitor.
7. Chromatographic separation of carbohydrates and aminoacids.
8. Simple histological studies on plant tissue.

B. MICROBIOLOGY

1. Preparation and sterilisation of nutrient media.
2 Cultivation and morphological study of common species of bacteria yeasts and moulds.
3. Isolation of pure culture from natural sources.
4. Imunelation of bacteria Haemoeytometer, standard plate count MBRT tests for milk.
5. Bacteriological analysis of water.
6. Microbial spoilage of various foods and effect of extrinsic and intrinsic factors on food spilage.

BOOKS RECOMMENDED:

1. Microbiological Methods, C.H.Collins & P.M. Lyme. Butterworth Co.Ltd., London.
2 Microbes in Action - A Laboratory Manual of Microbiology; H.W.Seeley (JR.) and P.J.Von. Denmark - Taraporewala I.,W. Pvt. Ltd., Bombay.
3. Introduction to Practical Biochemistry: D.T.Plummer, Tata McGraw Hill Co., New Dellii.

4. Hawk's Physiological Chemistry Edited by Bernard L.Oser, Tata McGraw Hill Pub. Co. Ltd., New Delhi.

SPECIAL TECHNOLOGY-ll
5PT04 (ii) PULP & PAPER TECHNOLOGY TECHNOLOGY OF PULPING PROCESSFS

Collection grading and storage of various raw material, wood preparation for pulping, units for measuring wood handling wood barking chipping. screening. chip. handling and storage. relationship between wood and quality.

Introduction to pulping. Fiber separation commercial processes. types of pulping processes. advances and trends in pulping.

Manufacture of mechanical pulp: Types. grades and uses of mechanical pulp stone ground wood process, types of grinders. theory of grinders. theory of grinding. variable in ground wood process, characteristics of groundwood pulp, pulp mill operations control, practice and testing methods, whole wood fiber manufacture. ground wood from pretreated wood, refiner mechanical pulping scheme, thermomechanical pulping.

Semichemical pulping and Semimechanical pulping; Neutral sulfite semichemical pulping, bisulfite semichemical pulping, craft semichemical pulping. cold soda semichemical pulping, hot sulfite chemomechanical semichemical pulp.

Sulfite pulpinp. Description of various sulfite processes, sulfite liquor preparation. variables in sulfite pulping. mechanics and kinetics of sulfite pulping. delignification, digestion in sulfite process. characteristics of sulfite pulp.

Alkaline pulping: General description of alkaline pulping process. alkaline digestion. chemical reactions during alkaline digestion. Variables in alkaline pulping process, digester operation. material and heat balance bamboo. reeds. hemp. jute, etc.

Recent advances in the field.

BOOKS RECOMMENDED :

1. Pulping processes by A.Rydholm. Interscience Pub., John Wiley &
Sons Inc., New York. London. Sydney.
2 Pulp & Paper: Chemistry & Chemical Technology, 3rd Edn., Vol I by James P.Casey, John Wiley & Sons, New York.
3. Pulp and Paper Manufacture, 2nd Edn., Vol I by Ronald G.McDonald.
4. Pulp and Paper Science Technology. Vol. I by C.E.Libby. McGraw Hill Co.
5. Hand book of Pulp & Paper Technology. 2nd Edn.. by Bitt Van Nostrad. Reinhold Co.. New York, London.

SPECIAL TECHNOLOGY -II (PRACTICAL) - LAB
5PC10 PULP & PAPER TECHNOLOGY

Analysis of fibrous materials; Pulp analysis: Determination of moisture ash content, permaganate number, copper number, kappa number of pulps 2, B, V, cellulose, solubility of pulp in alkali.

Analysis of non-fibrous materials: Analysis of black, green and white liquors, bleaching powder, soda ash, caustic soda, lime stone etc.

Books Recommended :

I. Technology of Textile Properties by M.A.Taylor,
2. Textile Analysis by S.K.
3. Identification of Textile Materials, 7th Edn., Textile Inc., Manchester,7.
4. Analytical methods for a Textile Lab., 2nd Edn., AATCC monog No.3 Research Triangle Park. North Carolina, Printed in U.sA
5. ISI Standards for Textile Testing
6. Textile Testing by Sinkale.

5OT04 SPECIAL TECHNOLOGY-ll
CHEMIS1RY AND BIOCHEMISTRY OF FATS
(iii) (OIL & PAINT TECHNOLOGY)

Techniques of separation of fats and fatty acids : Low temperature crystallization, esterification, urea adducts, counter distribution, chromatographic methods of separation with special reference to thin-layer chromatography and gas-liquid chromatography.

Methods for quantitative investigation on the component, fatty acids of natural fats and processed fats.

Lipase hydrolysis, X-ray diffraction and polymorphism of glycerides and other fatty acids and their derivatives. Dilatimetric measurements and their significance.

Infrared (IR), Ultraviolet (UV), Unclear Magnetic Resonance (NMR) and mass spectroscopy for the analysis of fatty materials.

Reichert-Missel and Polanske and Krischner values. Advanced method of analysis of fats, fatty acids and glycerides. .

Chemical reactions pertaining to the manufacture of fatty acid derivatives including metal salts other than alkali metals.

Quantitative investigation of component triglycerides of natural fats. Theories of fatty acid distribution in natural fats. Effect of fatty acid distribution on the physical properties. Polymorphism of fats and fatty acids. Biosynthesis of fatty acids, phosphlipids and triglycerides in plants and animals. Elongation and desaturation of acyl chains. Biological utilization of fats. Fat assimilation;

Essential fatty acids.
Recent advances in the field.

Books Recommended :

1. Industrial Oil and Fat Products: A.E.BaiIey : Interscience Publishers, New York, Latest Edition.
2 Fatty Acids: K.S. Markley (5 Volumes),lnterscience Publishers, New York, Edn., Latest Edition.
3. Structure and Utilization of Oil Seeds : J.G.Vaughon.
4. Melting and Solidification of Fats : A.E.Bailey, Interscience Publishers, New York, Latest Edition..
5. The Analysis of Fats and Oils: V.C.Mehlenbacher : The Garrard Press Champing, Edn., Latest Edition..
6. Progress on the Chemistry of Fats and other Lipids: T.T.Homan, W.O. Lundberg and T.Malkia, Pergamon Press, New York, Latest Edition (7 Vols.)
7. The Chemical Constitution Natural Fats: Wiley Books Publishers, New York, Latest Edition..
8. Vegetable Fats and Oils: G.S.Jamiesan, Renehold Publishers, New York, Latest Edition..
9. Vegetable Fats and Oils: E. W.Eckey : Renehold Publishers, New York, Latest Edition..
10. Gas-Liquid Chromatography - Theory and Practice: S.Dal Nagore and R.SJuvent; Interscience Publishers, New York, Latest Edition.
11. Lipid Chromatographic Analysis: C.V.Marinelt.
12. Fatty Acid Synthesis and Application: N.E.Bednareyk & W.L.Erickson.
13. The Lipids: H.D.Dauel : Interscience Publishers, New York, Latest Edition.
14. Analysis and Characterization of Oil, Fats Products : H.A.Bookenoogen.
15. Thin-layer Chromatography: Babbit.

SPECIAL TECHNOLOGY - II (PRACTICAL) - LAB
5OT10 OIL & PAINT TECHNOLOGY

Analysis of nickel catalyst and acids oils, Preparation of mixed fatty acids and determination of composition.Analysis of commercial fatty acids. Preparation of pure fatty acids. Determination of mono, di and tri-glycerides. Analysis of soaps and detergents. Detection of Adulteration. Analysis of Oils by thin layer and column chromatography.

SPECIAL TECHNOLOGY-II
5PC04 (iv) PETRO CHEMICAL TECHNOLOGY-II
PETROLEUM REFINING TECHNOLOGY

Petroleum refining industry in India, practice and prospectus : Commercial petroleum products, quality requirements.Indian specifications.

Testing methods and their significance: crude assay, refining processes, integration of these processes:. typical refining schemes in India. Descriptive account of atmosphere , vaccum distillations, use of process steam, steam stripping vaccum producing systems.etc.

Industrial practice of various conversion processes, such as catalytic cracking, hydro-cracking,cooking visbreaking, polymerization, alkylation, hydro-desulphurisation etc. and their role and place in Indian refineries.

Production of cube base stocks, solvent extraction, dewazing, finishing and blending; Finishing processes in a modem refinery.

Petroleum speciality products.

Descriptive account of various aspects of a refinery such as instrumentation and automatic control, refinery utilities off site facilities refinery layout, corrosion, safety, energy saving, environmental aspects etc; conservation of petroleum products, Techno-economic aspects of optimum refining schemes.

Recent Advances in the field.

Books Recommended :

1. Petroleum Refinery Engg., W.L. Nelson : Mc Graw Hill Kogakusha, 4th Edn., Latest Ed.
2. Modem Petroleum Technology, Applied Science. G.D.Hobson and W.Pol Publisher 4th Edn., Latest Ed.
3. Petroleum Processing, Principles and Applications, RJ .Hengatabes,
   McGraw Hill, Latest Ed.
4. Petroleum Refiing, Technology and Economics: J.H.Gary and G.E., Hand-work, Merceidekker, New York, Latest Ed.
5. Petroleum Processing Handbook : W.E.Bland and P.L.Daviason. McGraw Hill, Latest Ed.
6. Petroleum Refinery Manual : M.M.Noel, Rinebold, New York, 1959.
7. V.B.Guthrie, Petroleum Products Handbook, McGraw Hill, 1960.

SPECIAL TECHNOLOGY-II (PRACTICAL)- LAB
5PC10 PETRO-CHEMICAL TECHNOLOGY-II

Analysis and testing of petroleum and petroleum products.

ASTM distillation of motor gasoline, kerosene and high speed diesel, viscosity index. demulsification number and forming characteristics of lubricating oils; Existent gum in motor gasoline; oxidation tests for lubricating oils, oxidation stability of gasoline, water washout characteristics and roll stability of grease. Ductility of bitumen; Electric strength-transfoer oil, PONA analysis by FIA method, aniline point method liquid vapour pressure, Heat of combustion of liquid hydrocarbon fuels, calorific value of' gases, mercaptan sulphur content, salt content, Sulphur by lamp and bomb methods, P,Ca and Cl lubricating oils, study of Vapour-Liquid equilibrium for binary systems using Othmer still study of ternary equilibrium systems and representation triangular diagrams.

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5 FE CT 05 FREE ELECTIVE - I
(2) ECONOMICS AND MANAGEMENT

SECTION-A

Unit I : Nature and Scope of Economics, introduction to managerial economics.

Demand concepts : Demand specification, types of demand.

Demand analysis : law of diminishing utility, Consumer's surplus.

Demand forecasting : Concept of forecasting, types of forecasts (8)

Unit II : Production Concept, production function, Laws of return, scales of production, factors of production, production planning and control : Its meaning, essential factors for the success of production planning and control. (8)

Unit III : Meaning of Management, Principles of management, meaning and principles of scientific management, levels of management, delegation and authority, Organisation, forms of organisation. (8)

SECTION-B

Unit IV : Sources of Finance Banking and Credit structure in India : Financial institutions, promotional polices and programmes of industrialisation, functions of Commercial Banks, functions of Central Bank. (8)

Unit V : Economic and Social Environment : Brief idea about economic environment of business, socio-cultural environment, Health hazards of chemical industries, awareness about AIDS & other diseases.

Brief idea about economic recession & its effect.

Introduction to World Trade,

Globalisation, Libertion and their effects.

Introduction to Patenting & intelleatual property protection (8)

Unit VI : Entrepreneur and Entrepreneurship :

Entrepreneurial competencies, institutional interface for small scale enterprises, opportunity scanning and identification.

Market assessment for SSE, choice of technology and selection of site, Ownership structure and organisational framework, preparation of business plan, main features of Indian factories act & minimum wage act.

Brief idea of Taxation in India. (8)

BOOKS RECOMMENDED :

1) Managerial Economics : K.K.Seo, Richard D. Irwin Inc.
2) Engineering Economics : J.L.Riggs, McGraw Hill, New York, Latest Edition.
3) Managerial Economics : Adhikary M., Khosla Pub. House, New Delhi.
4) Small Business Management Fundamentals : Dan Strenhoff and J.F.Burgess, McGraw Hill Book Company.
5) Effective Small Business Management : Richard M.Hodgills, Academic Press Incorporated, Harcourt, Brace Jovanovich.
6) Marketing Management for Small Units : Jain Vijay K., Management Publishing Co., Latest Edition.
7) Marketing Management :- Analysis, Planning, Implementation and Control : Kotler, Phillip, Prentice Hall of India Pvt. Ltd., Latest Edition.
8) Modern Economics Theory : K.K.Dewett.

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5 CT 06 COMMUNICATION SKILLS

Unit I : Comprehension over an unseen passage.

Comprehension - A - word study :-

Synonym, antonym, meanings, matching words, adjectives,

adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.

Comprehension - B - Structure study :-

Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.

Active and passive forms, negative and interrogative, punctuation and capitalization. (10 Hours)

Unit II : Theoretical background - importance of communication, its process, model of communication its components & barriers.

Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.

Non-verbal communication, types of graphics and pictoral devices. (10 Hours)

Unit III : Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc.

Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews.

Methodology of conduction of meetings, seminars, symposia, conference and workshop. (10 Hours)

BOOKS RECOMMENDED :

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

5 CT 11 COMMUNICATION SKILLS LABORATORY

Objective :

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation.

The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

TEXT BOOK : Norman Lewis : Word Power Made Easy

http://www.teachingenglish.org.uk

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SIXTH SEMESTER

FREE ELECTIVE - II

6 FECT 05 (3) CHEMICAL TECHNOLOGY

Study of the following proccsscs :

1. Nitration: Nitrating agensts. Kinetics and mechanism of aromatic nitration. Thennodynamics of nitrations. Equipments for nitration. Mixed acids for nitration and typical industrial nitration processes e.g. preparation of nitrabenzene, chloronitronapthalene and acetafiline.
2. Sulphonation and Sulfation : Sulphonation and sulfating agents:Kinetics, mechanism and thermodynamics. Industrial equipment and techniques. Technical preparation of sulphonates and sulphates. Sulphation of lauryl alcohol, dimethyl ether etc.
3. Hydrogenation: Catalytic Hydrogenation. Kinetics and thermodynamics of hydrogenation reactions. Apparatus and material of construction, hydrogenation of fatty oils. Synthesis of methanol. Hydroforming of naptha. Hydrogenation of heavy oils.

4. Halogenation: Thermodynamics and Kinetics of halogen. Pathohalogenation. Equipment and design for halogenation. Technical preparation or halogen compounds e.g. allyl chloride. D.D.T...B.H.C....Chlorobenzene dichlorodifluromethane. vinyl chloride etc.
5. Oxidation : Liquid and Vapour phase oxidation. kinetics and thermochemistry. apparatus for oxidation. Technical oxidation of isoeurenol. acetaldchyde. Cyclohexane Iso-propylbenzene. napthaleum refinary, electro-plating, tanning, coat mining and radio waste.
6. Wastewater Treatment : Classification of wastewater. Methods of treatment. sludge treatment and disposal. treatmcnt of effluent water from textiles rayon. pulp. dairy, distillery Petroleum refinary, electro-plating, tanning, coal mining and radio active waste.
7. Water : Source of water. Impurities in water. Requirements of water by different industrics. treatment of water for industrial and domestic purpose. boiler feed water treatment. reuse of water. Water conservation.
8. Industrial gases : CO, CO_2, CO_3, H_2,O_2, N_2, SO_2, C_2, H_2 synthesis gas, rare gases : Helium nitrous oxides.
9. Industrial Acids : Sulphuric, Nitric and hydrochloric acid.
10. Marine Chemicals : Salt from sea water. by product of salt industry viz, Bromine and Iodine.
11. Fertilizers: Ammonia Nitrogenious of fertilizers. Phosphatic fertilizers. Potassic fertilizers. Compound and complex fertilizers. Miscellanceous fertilizers,
12. Electrolytic and Electro-chemical Industries: Chlorates, perchlorates. Primary and Secondary cells, artificial abrasives. Calcium carbide Refractory carbides. borides, silicides and nitrides.

BOOKS RECOMMENDED:

1. Unit Processes in Organic Synthesis by P.H.Groggins. Vth Edn.. International Students Edn.. McGraw Hill Co.
2. Chemical Technology -Vols I, II, III by D.Venkateswarlu, Chemical Engg. Education Development Centre. I.I.T. Madras, Latest Edition.
3. Chemical Process Industries by R. N. Sherve and J. A. Brink. McGraw Hill, Co., Latest Edition.
4. Chemical Technology in two parts. Edited by I.P.Mukhlyanov, Mir Publishers Moscow, Latest Edition.

6 CT 01 PROCESS EQUIPMENT -DESIGN & DRAWING

SECTION-A

Unit I : Material behaviour under stresses, theories of failures. (8)

Unit II : Fabrication methods and their effects : Design method for atmospheric storage vessels, unfired pressure vessel subjected to internal and external pressure. (8)

Unit III : Vessels for high pressure operations, Agitated vessels. Tail columns, internals of the reactors. (8)

SECTION-B

Unit IV : Design of proess equipment accessories and support systems. (8)

Unit V : Complete design and preparation of working drawing for typical process equipment, such as large storage vessels, thick wall pressure vessels. Self supported tall columns, agitated pressure vessels with heat transfer requirements etc. (8)

Unit VI : Design and layout of piping system and preparation of piping diagram for a typical process. Material selection and piping coding. (8)

PRACTICALS : Based on the above syllabus.

BOOKS RECOMMENDED :

1) Process Equipment Design : I.E.Brownell, E.H.Young, John Wiley, Latest Edition.
2) Process Equipment Design : M.V.Joshi, McMillan, Latest Edition.
3) Introduction to Chemical Engg. Design, Mechanical Aspects
4) I.S.Code for Unfired Pressure : IS No. 2825 - 1969 pressure vessel.
5) Process Equipement Design & Drawing : S.D.Dawande.
6) International & Indian Standard codes for Piping.
7) Process Design of Equipments, 3rd Ed, S.D. Dawande, Vol I & II, Central Techno Pub., Nagpur

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6 CT 0 3 INSTRUMENTATION & CONTROL

SECTION-A

Unit I : Measuring Instruments : Qualities of measurement, elements of instrument, static & dynamic characteristics, measurements of temperature and levels.

Unit II : Measurement of pressure, vacuum, humidity & pH in process industry.

Unit III : Methods for composition analysis. Principle and techniques of instruments for composition analysis in process industry, such as chromatography, spectroscopy, refractrometry etc.

SECTION-B

Unit IV : Flow measuring instruments : Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.

Unit V : Introduction to Simple system analysis : Laplace Transformation. Block diagrams, linearization. First and higher order system.

Unit VI : Frequency response, distributed parameter system, dead time.

Feed back control, servo and regulator control. Time domain closed loop responses, closed loop frequency response.

BOOKS RECOMMENDED :

1) Industrial Instrumentation : Eckman, Wiley Eastern
2) Instrumental Methods of Chemical Analysis : Erwing, McGraw Hill.
3) Instrumentation & Process Measurements : W.Bottom, Orient Longman.
4) Industrial Control & Instrumentation : W.Bottom, Orient Longman.
5) Outlines of Chemical Instrumentation & Process Control : A. Suryanarayan, Khanna Pub., New Delhi.
6) Donald R. Cougha Nowr : Process Systems Analysis and Control, McGraw Hill Pub., New York.
7) Vyas R.P. : Process Control and Instrumentation, Central Techno Pub., Nagpur.
8) Patranabis D. : Principles of Industrial Instrumentation, 2nd ed., Tata McGraw Hill Pub. Co., New Delhi.
9) Patranabis D. : Principles of Process Control, Tata McGraw Hill Pub. Co., New Delhi.
10) Gaikwad R.W., Misal S.A. : Process Dynamics & Control, Central Techno Pub., Nagpur.
11) Stephanopoulos G. : Chemical Process Control and Introduction to Theory & Practice, PHI, Latest Edition.
12) Considine D.N. : Process Instrumentation & Control Handbook, McGraw Hill.

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6 FT04 SPECIAL TECHNOLOGY-III
(i) FOOD TECHNOLOGY-III
MICROBIOLOGY AND PRINCIPLES OF FOOD PRESERVATION

Brief historical background, classification and terminology of micro-organisms. Study of morphology and physiology of bacteri-yeasts moulds and actinomicetes, introduction to viruses and bacteria. Methods of isolation, cultivation and enumeration of micro-organisms, Nutrition, reproduction and metabolism. Synchronised and balanced growth and continuous cultivation of microorganisms.

Control of microorganisms by physical and chemical methods, Sterilisation and disinfection, inadiation antibiotics, evaluation of antimicrobial agents, Microbiology of air, water and sewage. Immunological methods. Bacteriological analysis of foods, Role of microorganisms in food spoilage.

Principles of food preservation. Preservation of food by means of low temperature. Freozedrying thermal processing irradiation, dehydration chemicals antibiotics and C.A.storage. Sources and prevention of contamination. Food Production and Microbial toxins, Principles of a amitation in food technology and safety of foods. Fermented food like bread, cheese, yogurt, vinegar, alcohol, pickles.

Recent advances in the field.

BOOKS RECOMMENDED:

I. Food Microbiology: W.C.Frazier, Tata McGraw Hill Pub., Co., Bombay.
2. Microbiology: MJ.Pelkzar, Ried R.D., E.C.S.Chan, Tata McGraw Pub., Co. Ltd., New Delhi.
3. Fundamentals of Microbiology: M.Frobisher, W.B.Saunders Co., Philadelphia.
4. Microbiology: P.L.Carpenter, W.B.Saunders Co., Philadelphia.
5. Microbiological Methods: C.H.Collins & P.M.Lyne, Butterworth and Co., London.
6. Food Processing Operations: M.A.Goslyn & J.Hold, The AVI Pub. Co., INC, Westport.
7. Principles of Food Science, Vol. II : G.Borgestrom the MacMilIan Co. Ltd., London.
8. Technology of Food Preservation: Destosier, Norman W., AVI Pub. Co., INC, London.
9. Practical Food Microbiology and Technology: H.H. Weiser, The AVI Pub. Co., Westport (Coun.)

SPECIAL TECHNOLOGY PAPER-Ill
6 PT 04 (ii) PULP & PAPER TECHNOWGY
PULPING PROCESSES-II

Pulp Washing, Bleaching and Recovery of Spent Chemicals : Washing of Pulp : Delibration of sulphate pulp, brown stock washing, screening and clearing of sulphate pulp, washing of sulphite pulp, screening and clearing of sulphite pulp, screening and clearing of other pulps.

Recovery of spent chemical : Liquor recovery in alkaline pulping, evaporation of kraft liquors, recovery furnance, recausticizing treatment to digester and evaporator condensates, recovery of alkalining sulphate, turpentine, tall oil and other alkaline pulping by products.

Recovery process in sulfite pulping, Calcium, Magnesium, Amonia and Sodium bases recovery, other sulfitex recovery methods, recovery of by-products from sulfite process, whole spent liquor and ligoo sulfonates. Vaniline and alcohol from sulfite spent liquor, fermentation of sulfite spent liquor to produce proteins.

Bleaching: History of Bleaching, bleaching of mechanical pulps, semichemical pulps, chemi-mechanical and chemical pulps, multistage bleaching, control procedures in bleaching process, colour reversion of bleaching pulps, environmental aspects of Bleaching chemicals.

Recent advances inthe field.

Books Recommended:

1. Pulping Processes by S.A.Rydholm.
2. Pulp & Paper : Chemistry and Chemical Technology, 3rd Edn., Vol. I by James P.Casay
3. Pulp & Paper Manufacture, 2nd Edn., Vol.-I by R.P.Mc Donald.
4. Hand Book of Pulp & Paper Technology, 2nd Edn., by K. W. Britt.

6CT02 COMPUTER PROGRAMMING AND APPLICATIONS

Note : Application of the following techniques for problems of interest in chemical engineering, writing and testing of programs written in C Language.

SECTION-A

Unit I : Numerical solution of first order differential equations with initial condition, Euler's method, Runge-Kutta method.

Unit II : Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method.

Unit III : Roots of algebric and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental and algebric equations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems.

SECTION-B

Unit IV : Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial.

Unit V : Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods.

Unit VI : Computer programming in modular form, use of subroutine libraries, Block diagrams of preliminary aids in programming, capacity optimization.

PRACTICALS : Based on above theory.

TEXT BOOK : Digital Computation for Chemical Engineering by Leon Lapidas, McGraw Hill, Latest Edition.

6 OT 04 SPECIAL TECHNOLOGY-III
(iii) OIL & PAINT TECHNOLOGY OF OIL BEARING MATERIAI:S

Domestic and World production of oil seeds and oils, storage, sampling, Grading of oil seeds and oils. Pre-Extraction treatments of oil seeds. Mechanical expression, solvent extraction and other methods of recovery of oils and fats. Economic aspects of these processes, processes and plants employed for refining, bleaching, deororisation and hydrogenation of oils and fats.

Manufacture of butter, Ghee, margarine, vanaspati and confectionary fats. Transesterified oils, fats, winterization of oils. Manufacture and evaluation of ancillary materials such as activated earths, activated carbons, nickel catalyst for hydrogenation. Cooking and salad oils, plastic shortening agents.

Environmental aspects in Oils seeds and oil processing units. Effective control according to Indian Standard specification.

Non Glyceride Constituents, general method of upgrading and utilization of oils and fats, oil-cakes and other products. Synthetic fatty acids and glycerides. Recent advances in the field.

BOOKS RECOMMENDED :

1. Cottonseed and Cottonseed Products : A.B.Bailey, Interscience Publishers, New York, Latest Edition.
2. Industrial Oil and Fat Products: A.E.Bailey, Interscience Publishers, NewYork, Latest Edition.

3. Soyabeans and Soyabean Products: K.B.NarkIev, Interscience Publishers, New York, Latest Edition.
4. Hydrogenation of Fatty Oilseeds : Waterman, Lquosevier Publishers, New York, Latest Edition.
5. Fatty Acids: K.S.Markely (5 Vols.), Interscience Publishers, New York.
6. Continuous Processing of Fats : M.K.Schwitzer, Latest Edition.
7. Refining of Oils and Fats for Edible Purposes: A.J.C. Anderson, Academic Press, New York.
8. Vanaspati Industry: G.S.Hattangadi
9. Practical Treaties on Vegetable Ghee Manufacture: Varma & Jaidev.
10. Solvent extraction of Vegetable Oils: H.Y.Parkb.
I l. Refining and Technology of Oils and Fats: T.N.Mahatte, Small Business Publication, New Delhi.
12. Food Oils and their Uses: TJ.Weiss, Latest Edition.
13. Bleaching Earths: M.K.H.Siddiqui, Latest Edition.
14. Progress in the Chemistry of Fats and other Liquids: R.T.Holman, M.O.Luadberg & T.Malkin, Pergamon Press, New York (7Vols.)
I5. Vegatable Fats and Oils: E. W.Eckay, Rinehold Publishers, New York, Latest Edition.
16. The Chemistry, Flavouring and Manufacture in Chocolate, Confectionary and Cocoa: H.PJenson, Blackiston Publishers, Philadelphia, Latest Edition.
17. The Butter Industry: O.F.Huzoker, Latest Edition.
18. Margarine: A.J.C.Anderson, Academic Press, New York, Latest Edition.

SPECIAL TECHNOLOGY-III
6 PC04 (iv) PETROCHEMICAL TECHNOLOGY-Ill
PETROLEUM REFINERY ENGINEERING CALCULATIONS

ASTM, TBP, EFV distilIation curves, computation of the curves from any one type by methods such as those or Nelson, Simister etc. Computation of various properties of petroleum fractions such as VABP,MABP, thermophysical properteis from refinery engineering chart. Phase behaviour of multicomponent hydrocarbon systems retrograde phenomena, K values and their estimate for complex mixtures K values corelations; Flash equilibrium calculation for multi component system by method of successive approximations and simple methods such as that of McHenry; Calculation of bubbic and dew points for complex mixtures, construction of phase diagram, successive flash for complex mixtures, multicomponent fractionation.

Separation criteria in crude oil fractionation, comparison with the simplest light hydrocarbon fractionation. Watkins method of covering crude TBP to product TBP curve, concept of overflash.

Energy balance in a topping tower, types of reflexes and calculations involved, estimation of top side draw bottom and stripper temperatures. Brief account of topping tower design procedures: according to Nelson, Watkins, Van Winkle (psudeo component design method), tray design.

Entrainers and solvents for hydrocarbon separation by azeotropic and extractive distillations. Types of pipe still heaters, calculation of radiant absorption rates, Wilson Lobo, Hetel equation, Labo Evans method piple still design.

Problems illustrating the use of solvent extraction, absorption and stripping in refinery operations and natural and refinery gas processing; multicomponent absorbers and strippers, calculation by Kremser-Brown absorption factor procedure.

Heat exchangers in refinery design and operational problems, fluid mechanics and refinery applications. Use of combustion charts.

Recent advances in the field.

(The subject has to be covemed entirely by Numerical)

Books Recommended:

1. Petroleum Refinery Engineering : W.L.Nelson, McGraw Hill, Kogakusha, 4th Edn., Latest Edition.
2. Petroleum Refinery Distillation: R.N. Watkins, Gulf Pub. Co., Texas, Latest Edition.
3. Data Book on Hydrocarbons: J.B.Maxwall, K.E.Kriegar Pub. Co., New York, Latest Edition.
4. Distillation: M. Van Winkle, McGraw Hill, Latest Edition.
5. Handbook of Natural Gas Engineering: D.L.Katz & Others, McGraw Hill, Latest Edition.
6. Applied Hydrocarbon Thermodynamics: W.C.Edmister, Gulf Pub. Co., Latest Edition, Vol. I & II.
7. Surface Operations in Petroleum Production: G.Y.Chilingar & C.M.Beeson, Elsevier, New York, Latest Edition.
8. Petroleum Processing Handbook: W.F.Bland & R.L.Davidson, McGraw Hill, Latest Edition.
9. Chemical Engg. : J.M.Coulson and J.F.Richardson, Pergamon Press 3rd Edn., Vols. I & II, Latest Edition.
10. Equipment Design Handbook for Refineries and Chemical Plants: Frank L.Evans, Jr., Gulf Pub. Co., Houston, Texas, Latest Edition.

6 CT 09 MINOR PROJECT

Students are required to prepare and submit report on mini project on Software Development / Market Survey / Design / Fabrication / Site Visit / Some Experimental Investigation / Validation in the relevant field under the guidence of teacher.

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FOUR YEAR DEGREE COURSE IN
BACHELOR OF TEXTILE ENGINEERING
SEMESTER - V (CREDIT & GRADE SYSTEM)

5 TX 01 YARN MANUFACTURING –III

Section- A

Unit I : **Speed Frame-** History of development, object, construction & working of speed frame. Top arm drafting system, Construction Flyer, Spindle and presser for twisting & winding operation. Objects, construction and working of Differential Mechanism and Building Mechanism. Various Parameters affecting roving quality and production. Gearing and production calculations of speed frame. Faults in roving. Features of modern speed frame.

Unit-II : **Ring Frame-** Object, construction & working of ringframe, Details of Creel, Drafting system, Balloon control ring, lappet, Travelers, Rings, Aprons, top roller cots, spacers of ringframe. Compact Spinning- Introduction, Pneumatic compact spinning, Magnetic compact spinning,yarn properties of compact yarn. Comparison of normal ring and compact yarn.

Unit-III : **Ring Frame -** Spinning Geometry- Spinning Angle, Spinning triangle, Angle of Wrap.Formation of twist and its effects. Ring and traveler combination effect. Change places in ring frame. Gearing & Building Mechanism of ring frame. Building of cops, Types of spindles, Spindle drives. Draft and production calculation. Development in Ring Spinning.

Section - B

Unit-IV : **Ring Frame-** Drafting, types of drafting system, types of draft. Drafting force, Roller slip, Floating fibres, Drafting waves, Drafting capacity. Different Weighing methods, its advantages & limitation, Factors affecting on roller setting and drafting performance. End Breakages-Causes, Effect & Control. High speed drafting in ring spinning. Hairiness –causes control and effect. Yarn Faults- causes, effects and control.

Unit-V : **Doubling-** Object of doubling, twist and twist direction effects, Tension effects, Balanced and unbalanced yarn, Properties of folded yarn,Doubling methods –dry, wet ,Doubling machine – Ring doubler , Up twister, Two stage twisting machine, Two For One twister and Three for One twister, Comparison of doubling machines. Fancy yarns-Introduction, types. Method of production, yarn properties, end uses.

Unit-VI : Blending- Object of blending, Type of Blending ,Measures & selection of blend constitutes. Mechanism of blending. Blend Ratio, it's effect on yarn properties. Blend Irregularities, Modern blending machines.

Reference Books:

1. Short Staple Spinning –W.Klein
2. Cotton Spinning-William Taggart
3. Cotton Spinning-Gillbert R. Merill
4. Manual of cotton spinning –Butter Worth Series
5. Essentials calculations of Practical Cotton Spinning – Pattabhiram
6. Spinning of Manmade fibres and Blends on Cotton System-K.R.Salhotra
7. Practical Cotton Spinning – Pattabhiram
8. Spun Yarn Technology-Subramaniam
9. Ring Spinning- Dr. A.R. Khare

5TX 02 FABRIC MANUFACTURING-III

Section -A

Unit I : Knitting: - Introduction, Woven and Knitted fabric comparison, general terms and principles of knitting technology, basic mechanical principles of knitting technology, elements of knitted loop structure, stitches produced by varying the sequence of the needle loop intermeshing, type of knitting .

Unit II : Weft knitting- Comparison of weft knitted and woven fabrics. Weft knit structures:- classification, technical terms, symbolic representation, anatomy of loop-stitch, cross-over points and configuration, laddering effect, characteristics of single jersey of plain structure, rib-knit structure, interlock-knit purl-knit. Weft knitting machines- plain knit, circular rib, circular interlock, purl. Float and tuck stitches- structure, effect of float and tuck structure.

Unit III : Warp knitting- Comparison of warp knitted and woven fabrics. Basic warp knitting principle- Construction of warp knitted fabrics, warp beams, guide bar. Warp knit structure:- classification, technical terms, symbolic representation, underlap and overlap, closed lap and open lap stitches. Warp knitting machine- classification, knitting elements and cycle on tricot machine, compound needle elements and its knitting cycle, difference between Tricot and Raschel machine.

Section - B

Unit IV : Nonwovens - History, definition, characteristics features and properties of nonwoven fabric, Comparison of nonwoven and

woven fabrics, differences in geometrical arrangement of fabrics in web, binding element and bonding structure. Classification of nonwoven fabrics by Albercht, by Krema and Meyer, by DIN standards, by their structure.

Unit V : Raw material for nonwoven production, function of fibre in nonwoven fabrics, effect of fibre properties on properties of nonwoven fabrics, application of industrial fibre in production of nonwoven, special fibre for nonwoven production, Brief overview of fibre preparation for nonwoven web formation. Different web formation technologies: - Airlaid web formation, Airlaying technology and Wet-laid web formation.

Unit-VI : Bonding technologies: - Mechanical bonding- needle punching, hydroentanglement, stitch bonding. Thermal bonding- contact, air and impingement, radiation/infra-red and ultrasonic. Chemical bonding- mechanism, method and drying, Fabrics for specific end use,

Reference Books :

1. Knitting technology by Ajgaonkar
2. Mannual nonwovens by Radko Kerma
3. nonwoven manufacture by Bannergee

5 TX 03 TEXTILE TESTING – I

Section- A

Unit- I : Introduction & Objects Of Testing. Tested Quality Schemes Like Wool Mark, ISI Mark.Introduction to Standards like ASTM, ISO, etc. Element of Statistics: Frequency Distribution Graphical Presentation Of Data, Measures of Location Like Mean, Mode, Median, Quartiles, Percentiles. Calculation Methods Measures Of Dispersion: Range, Quartile Deviation, Percentage Mean Deviation, Standard Deviation, CV%, Variance. Comparison of frequency distributions, Normal distribution.

Unit -II : Population values & sample values, Sampling Distribution, Standard Error, significance testing of mean & s. d., Level of confidence. Number of tests to be carried out, ANOVA (one way & two way) Quality Control Charts, X -chart, R-chart. Binomial & Poisson distribution, Correlation & Regression analysis.

Unit -III : Selection of sample for testing, Random sample, Biased sample, length & extent biased sample, sampling for raw cotton testing, Terms used in sampling, Fibre sampling from combed slivers, roving and yarns, Yarn sampling, fabric sampling.Moisture relations:

Introduction, Moisture Regain & content, measurement of atmospheric condition, regain- humidity relations & hysteresis. Absorption & desorption curves, effect of regain on fibre properties, Measurement of regain.

Section- B

Unit -IV : Fibre length measurement, Methods, Fibre sorter, Shirley Comb sorter, Analysis of Sorter diagrams, Uster staple diagram apparatus, Shirley photoelectric stapler, Fibrograph, Digital Fibrograph.Fibre fineness: Definition, Technical significance, principles of measurements. Gravimetric methods, optical methods. Microscopic methods, air flow methods, vibration methods, micronnaire value, The Sheffield micronnaire.

Unit -V : Maturity of Cotton : Introduction, Maturity ratio, Maturity Coefficient, Std. fibre wt. per cm., Determination of fibre maturity: NaOH Method, Dye Method, Air Flow Method, Polarized Light Method, Trash content: Measurement. Shirley analyzer, Cotton Colour, cotton grading. High volume instrument. Miscellaneous fibre properties: Friction & Cohesiveness, Cleanability static electricity compressibility & resilience, AFIS Tester.

Unit -VI : Yarn Dimension: Count, Direct & Indirect system of yarn numbering, Count Conversion, folded yarns, Measurement of Count, different methods, Yarn diameter.Twist: Introduction, Twist angle. Effect of twist on yarn & fabric properties, measurement of twist by different methods.

Reference Books :

1. Principles of Textile Testing: J. E. Booth
2. Textile Testing: Grover & Hamby
3. Physical Testing of Textiles: B. P. Saville
4. Textile Statistic: GAV Leaf

5 TX 04 TEXTILE COSTING AND ECONOMICS

Section- A

Unit- I : Costing: Meaning and various methods of costing, elements of cost, prime cost, over- head, factory cost, selling & distribution overhead, total cost, concept of BEP: Fixed cost, Variable cost.

Unit- II : Raw material purchase procedure, issue of material, bin cards, store ledger, material requisition slip, material transfer and

return slip, different basis of pricing of issued raw material (FIFO, LIFO, HIFO & Average)

Unit- III : Inventory: importance and meaning, consideration for fixing maximum and minimum stock to be maintained. Annual stock taking and perpetual inventory, ABC system of inventory control, Economic order quantity.

Section- B

Unit- IV : Economics: definition & scope, characteristics and classification of wants. Meaning of demand, law of demand. Supply, Law of supply. Price elasticity of demand, factors affecting elasticity of demand, demand supply interaction.

Unit- V : Type of markets: perfect market, imperfect market (monopoly, oligopoly, etc) money function, price level, inflation.

Unit- VI : Banking: commercial bank, function of commercial bank. Central Bank, function of central Bank. National income: definition, measurement of National Income, difficulties in measurement of National Income. International trade. Taxation: Direct and Indirect Taxes.

Assignments :

1) Determination of cost of yarn/kg.
2) Moisture content in relation to cost.
3) Cost calculation for standard fabrics.

Reference Books :

1. Elementary Economic Theory by K. K. Deweet and J D Verma
2. Cost Accounting by B. K. Bhar
3. Industrials Engineering and Management by O. P. Khanna

FREE ELECTIVE
5 FE TX O5 (i) TECHNICAL TEXTILES

Section- A

Unit-I : Introduction: Definition and scope, Classification of technical textiles, Brief idea about technical fibres, Role of yarn and fabric construction, Composite material. Growth of industrial textiles, Engineering textile structures for industrial purposes. Difference with non-industrial textiles.

Unit -II : Filtration textiles: Definition of filtration parameters, Filtration requirements, Role of fiber, Fabric construction and finishing treatments, Dust filtration - general, Protective masks and high temperature filtration- purification and separation of gases - Cigarette filters - liquid filtration - solid liquid filtration, liquid - liquid separation - Textiles used for the above applications and their features.

Unit -III : Geotextiles: Definition of geo textiles - Basic functions of geo textiles, Brief idea about geosynthetics and their uses, Essential properties of geotextiles, Geotextile requirements for separation, filtration, drainage, reinforcement, protection and waterproofing - geo textiles in temporary and permanent road construction railway stabilisation -Fibre used and fabrics for above application. Geotextile testing and evaluation, application examples of geotextiles.

Section –B

Unit -IV : Medical textiles: Classification of medical textiles, Description of different medical textiles, Material used in bio-textiles; Non-implantations textiles; Textiles for extra-corporeal, Antimicrobial textiles - suture thread natural and synthetic - different types used - PTFE suture, used for cardio vascular textiles - woven, knitted - requirements of artificial blood vessels. Details of textiles used for vascular and hernia surgery - other uses in this surgery.

Unit -V : Protective Clothing: Brief idea about different type of protective clothing, functional requirement of textiles in defence including ballistic protection materials and parachute cloth, temperature and flame retardant clothing, chemical protective clothing, water proof breathable fabrics. Textiles in protective clothing: introduction, protection against heat, impact and others for safety. Fabrics in defence system and weapons; other applications. Automotive Textiles: Application of textiles in automobiles, requirement and design for different tyres, airbags and belts, methods of production and properties of textiles used in these applications.

Unit -VI : Sewing threads, cords and ropes: Types, method of production and applications, functional requirements, structure and properties. Sports and recreation textiles: Functional requirement of different type of product and their construction. Textiles in miscellaneous industrial applications: Introduction, paper makers felt, bearing and sealing materials, sound insulation, battery separators, electrical insulation textiles reinforced products; Transports bags and sheets; Fabrics to control oil spills; Canvas cover and tarpaulins.

Reference Books :

1. "Handbook of Technical Textiles", Ed. A R Horrocks and S C Anand, Woodhead Publication Ltd., Cambridge, 2000.
2. "Wellington Sears Handbook of Industrial Textiles", Ed. Sabit Adanaur, Technimic Publishing Company, Inc., Pennsylavania, USA, 1995.
3. "Engineering with Geosynthetics", Ed. G V Rao and G V S Raju, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.
4. "Industrial Textile", Ed., J Svedova, Elsevier, New York, 1990.
5. "Modern Textile Characterization Methods", Ed. M Raheel, Marcel Dekker, Inc., 1996.
6. Mukhopadhyay S K and Partridge J F, "Automotive Textiles", Vol. 29, No. ½, Textile Institute, 1999.
7. Sewing Threads' (Textile Progress, Vol. 30, No. 3/4, 2000) J. O. Ukponmwan, A. Mukhopadhyay & K. N. Chatterjee, Textile Institute, Manchester, UK, ISBN 1 870372387.
8. Medical Textiles-International Conference on Medical Textiles,Bolton,Woodhed Publication,Cambridge,1997
9. John,N.W.M"Geotextile"Blackie publication,Glasgow,1987
10. Industrial Textiles – Horrocks

FREE ELECTIVE

5 FE TX 05 (ii) FASHION AND CLOTHING SCIENCE

Section- A

Unit –I : Fashion Concept: Principles of fashion, Fashion cycle, Theories of fashion leadership, Changes in fashion, Fashion terminology for merchandising.Fashion Promotion: Fashion Promotion, factors influencing fashion promotion, Publicity, fashion show, Personal selling and communication process.

Unit –II : Fashion Marketing: Marketing concepts, fashion marketing, role of fashion marketer, market segmentation, Fashion marketing planning, Mass marketing, Marketing management, Franchising and goal of merchandiser and pricing policies.

Unit III : Fashion Buying: Interpreting customer demand, Developing fashion images, Analyzing and selection of resources. Buying in domestic & foreign market.Consumer Behavior: Psychological, Social, Economical, Practical, Family Background and other.

Section- B

Unit IV : Faric Properties: - Fabric Properties for woven and knit clothing: concept, significance importance and evaluation of dimensional stability, serviceability, drape, pilling, abrasion, crease, thickness, surface property and texture, Low stress mechanical properties, Comfort and Handle propertie, Moisture transmission properties. Finishes used to improve these properties.

Unit-V: Properties of Garment:- Comfort properties of garment, Permeability to Air, Moisture, and Light. Water Absorbency, wicking and retention properties. Quality parameters for assessing sew ability, seam strength, seam pucker, seam slippage Needle cutting and seam appearance. Tailor ability, Formability and factors affecting Tailor ability, Formability.

Unit VI : Clothing care Detergents: - Classification and function of soap and detergents. Composition of commercial detergents. Properties and application of various laundry agents like bleaching, optical, whitening agents, stiffeners, softeners, Stain removal: - Nature and classification of stains, principle and classification of stain removals, common stain and their removal.

Reference Books:

1. Concept of Consumer, Stephen Fringes, Fairchild Publication.
2. Fashion Merchandising, Stephen Fringes, Stone & samples publisher.
3. Creative fashion presentation, Polly Guerin, Stone & samples publisher.
4. Fashion Marketing, Easey, Stone & samples publisher.
5. Fashion Advertising and Promotion, Winter& Standlay Goodman, Stone & samples publisher.
6. Physical Testing of Textile, Saville

5 TX 06 Minor Project

5 TX 07 Yarn Manufacturing-III - Lab

10 to 12 Practicals based on syllabus of 5 TX 01

5 TX 08 Fabric Manufacturing -III - Lab

10 to 12 Practicals based on syllabus of 5 TX 02

5 TX 09 Textile Testing -I - Lab

10 to 12 Practicals based on syllabus of 5 TX 03

SIXTH SEMESTER
6 TX 01 FABRIC STRUCTURE
Section-A

Unit- I : Methods of fabric representation; repeat of weave; drafts; lifting plan; construction of weave from a given draft and lifting plan; construction of draft from a given lifting plan and weave. Plain weave; twill weaves; satin and sateen weaves; irregular sateen and satins & their derivatives. Weaves constructed on plain base, Weaves constructed on twill bases; Weaves constructed on satin or sateen bases:

Unit -II : Diamonds (even no & odd no); and diaper designs; honey comb (ordinary & Brighton), huck-a-back; mock leno; Stripe and check weave combination: Welts and piques: Ordinary, wadded, fast back welts; piques; idea of loose back, half fast back and fast back fabrics.

Unit- III : Light & pigment theory of colour, Elements of colour; simple colour and weave effects; construction of line effects; Hound's tooth pattern; Bird's eye & spot effects; Hairline effects; step pattern; idea of compound color and weave effects

Section- B

Unit- IV : Bed ford cords- plain face, wadded, crepon, twill face Bedford cords. Backed cloth: Warp backed cloth; weft backed cloth; backed cloth with wadding threads; warp and weft wadded cloths; reversible backed cloths. Classifications of double cloth construction; concept of self stitched; stitched by thread interchange; stitch by cloth interchange; centre stitched.

Unit -V : Leno structure: Principles of leno structures; methods of producing leno and idea of simple constructions, Weft-pile introduction; concept of simple constructions; Jacquard design, Card cutting machine, types of card cutting

Unit -VI : Terry pile introduction; formation of pile; simple terry weaves; idea of a terry pile forming mechanism. Tapestry structures: Introduction; idea of simple weft faced structures; carpet structures Different types of selvedges and their applications, Multi-axial fabrics: Introduction; weave.

Reference Books :

1. Grammar of Textile Design: Nisbet
2. Fabric Design: Blinov
3. Textile Design and Colour: Watson
4. Advanced Textile Design & colour: Watson
5. NCUTE- Woven fabric

6 TX 02 ADVANCE YARN MANUFATURING TECHNOLOGY
Section -A

Unit –I : Blowroom- Modern Mixers – Introduction, Principles, Construction , working, features – multimixer MPM, Aeromixer, unimix. etc. Modern Opener/Blenders/Cleaners - Blendomat BDT, Unifloc., Cleanomat System, ERM Cleaner, Striker Cleaner, Flock Feeder, Tuft Blender, Blender Feeder, Aero feed system. Modern opening,Cleaning, Blending machine .

Unit-II : Carding- Aerodynamic Card- Introduction, construction, working and limitation. Suction Cleaning in card, Chute Feed System. Autolevelling- Introduction, Principle, Types of control system-Closed loop, Open Loop, mix loop control system. Card mastertops, maxiclean card. Granular Card, Small Card & other developments of Card.

Unit-III : Carding-Development in L-in Region- Unidirectional Feed, Conventional Feed System, Multiple licker-in Deflector plate. Fibre Retriver. Intrigrated grinding System, On-line neps monitoring system. Features of Modern high production Cards- DK803,DK903, C-51.

Section-B

Unit-IV : Rotor Spinning- Introduction, Principle, Stages in yarn production, Advantages and Limitation of Ring spinning & Rotor Spinning Construction & Working of Rotor Spinning machine. Different types Groove & Naval. Process Parameters and its effects on yarn properties. Yarn Structure- core/sheath. Properties of Rotor Spun Yarn, Application. Comparison of Rotor & Ring Spun Yarn. Developments in Rotor Spinning.

Unit-V : Air jet Spinning, Air Vortex, Friction Spinning- Friction Spinning- Introduction, Principle, Stages in yarn production, Advantages and Limitation of Friction Spinning. Construction & Working of Friction Spinning machine- DREF-1, DREF-2, DREF-3, DREF-4, DREF-2000 ,3000. Process Parameters and its effects on yarn properties. Yarn Structure- core/sheath. Properties of Friction Spun Yarn, Application. Recent developments in Friction Spinning. Air jet Spinning - Introduction, Principle, Stages in yarn production,Construction & Working of Air Jet Spinning machine- MJS801H, MJS801,Yarn Structure, Properties of Air jet Yarn, Application. Air Vortex Spinning- Introduction, Principle, Stages in yarn production, Construction & Working of Air vortex Spinning machine,Yarn Structure, Properties of Air vortex Yarn, Application.

Unit-VI : Other Spinning Techniques- Wrap Spinning, Electrostatic Spinning, Ply Fil Spinning, Siro Spinning – Principle, construction, working, Yarn Structure & Properties of yarn. Woollen and Worsted spinning– Principle, construction, working, Yarn Structure & Properties of yarn. 1)Twist less yarns 2) Self Twist yarns 3) Network Yarns 4) Core Spun yarns.

Reference Books :

1) New Spinning System–W.Klein
2) New Spinning System- R.V.Gowda
3) Spun Yarn Technology-Oxtoby
4) Spun Yarn Technology, Vol-I-Subramaniam
5) Spun Yarn Technology, Vol-II-Subramaniam

6 TX 03 TEXTILE TESTING -II

Section- A

Unit -I : Hairiness of yarn measurement. Shirley yarn hairiness tester, Zweigle G 565, Uster tester-3 hairiness meter attachment. Yarn bulk. Textured filament yarns: testing of textured yarns. Friction: Coil friction & its measurement.

Unit -II : Types of tensile testing machines: CRL, CRE & CRT principle, pendulum lever principle with CRT, Stelometer, The balance principle, The Pressley fibre strength tester, loading by springs, inclined plane principle. Ballistic Tester, Electronic dynamometer strain gauge transducer, Instron, Tenso-jet.

Unit –III: Tensile Testing : Terminology & definitions load elongation curves, stress strain curve, initial young modulus, yield point, work of rupture, work factor, elastic recovery, instantaneous & time dependent effects, creep, factors affecting tensile properties of textiles. fibre strength testing, yarn strength testing, fabric strength testing

Section- B

Unit -IV : Evenness Testing: Introduction, nature of irregularity. Index of irregularity, variance length curves, methods of measurement & assessment of irregularity of sliver, roving & yarn. Clasimat yarn fault test.

Unit -V : Electronic capacitance tester, photoelectric testers. The cause and effect of irregularity, interpretation of results of irregularity tests, determination of periodic variation. Spectrograph, Uster yarn standards, Location of sources of periodic faults.

Unit VI: Fabric Dimension: Length, Width, Thickness, their measurement, Fabric weight, ends & picks per inch, crimp of yarn in fabric, crimp & fabric properties, measurement of crimp, cloth cover & fabric geometry.

Reference Books :

1) Principle of Textile Testing-I.E. Booth
2) Physical Testing of Textiles - B. P. Saville
3) Textile Testing - Grover & Hamby.

6 TX 04 APPAREL MERCHANDISING

Section-A

Unit-I : Organization of the Apparel Business- Introduction to Apparel Industry, organization of the apparel industry, types of exporters, Business concepts applied to the Apparel industry- International trade.

Unit- II : Marketing- Functional organization of an apparel firm. Responsibilities of a marketing division- marketing objectives and strategies- marketing research -types of markets: Retails and wholesale strategies for merchandise Distribution - retailers – sourcing flows and practices. Marketing plan. Labeling and licensing.

Unit-III : Merchandising- Definition of merchandising - functions of merchandising division - Role and responsibilities of merchandiser-different types of buyers- Communications with the buyers- awareness of current market trends- product development- ling planning line presentation.

Section-B

Unit IV: Sourcing- Need for sourcing - sourcing materials- manufacturing resources planning principles of MRP- Overseas sourcing- sourcing strategies. Supply chain and demand chain analysis - Materials management for quick response -JIT technology.

Unit- V: Documentation-Order confirmation, various types of export documents, pre-shipment post- shipment documentation. Terms of sale, payment, shipment etc. export incentives: duty drawback. DEPB, I/E incentives duty drawback, DEPB, I/E: license- exchange control regulation - foreign exchange regulation acts - export management riskexport finance. WTO / GATT / MFA - Functions and objectives, successes and failures.

Unit –VI : Quality Management System- ISO 9000 Quality Policy, data, records and traceability documenting the Quality System, quality manual, quality audit, ISO 9000 Registration ISO 14000.

Reference Books:

1. D. Sinha.. - Export Planning and Promotion, -II Ms, Calcutta (1989)
2. Tunin K Nandi.,-Import-Eeport Finance "IIMS, Calcutta (1989)

3. Elaine stone. Jean A Samples., - Fashion Merchandising, "McGraw Hill Book company(1985)ISBN: 81-07-O6l742-2
4. S. Shivaramu.-'Export Marketing - A practical guide to Exporters", Wheeler publishing (1996) ISBN: 81-7544-166-6.
5. J,A. Jamow; M , Guerreiro. B. Judelle., - Inside the Fashion Business" Publishing Company (1987) ISBN: 0-02-360000-4.

FREE ELECTIVE - II
6 FE TX 05 (i) COMPUTER AIDED TEXTILE & FASHION DESIGNING

Section- A

Unit - I : Introduction to textiles: Fibers; Natural and synthetic, Parameters, uses. Yarn: Types of yarns, numbering system, Quality parameter of yarns and uses. Fabric: Types of fabric, fabric design, comforts properties of fabric and uses. Fashion: Introduction to fashion and apparel design.

Unit - II : Origin of fashion, Fashion Theories: Fashion of different eras, French and Greek revolutions, fashion promotion, style-fad-trends. Fashion Design fundamentals, elements of art, Definition of line shape, form, size, space, texture and colour.

Unit - III : Fashion software: Reach Fashion & Reach CAD, Configuration and Installation, commands, library, model E-fashion style, photo, material studio,

Section- B

Unit - VI : Display of fashion materials: definition and importance, source technique and window display, classic fashion shows. Important fashion centers of the world and India**.**

Unit - V: Computer aided designing: Fashion sketching, color matching and computer graphics. Autotex software Introduction, Configuration and Installation, Colour Library, Weave library, Checks & stripes, yarn library, Dobby, CAD in Dobby industry

Unit -VI : Computer aided designing, fabric simulation, generation of Peg plan report, generation of report colour combination, Create design in weave library, Electronic jacquard, printing of weave, use of digital pen

Reference Books :

1. E.P.G Gohl, "Textile Science" CBS Publishers & Distributors, New Delhi, (India)
2. Bernard P. Corbman, " Textiles Fiber to Fibric" McGraw-Hill International Editions, Singapore

3. Tate and Sharon Lee, "*Inside fashion design*", Harper Publication Inc., UK (1976).
4. Mary Kefgen, "*Individuality in Clothing – Selection and Personal Appearance*", Mac Millan Publications, New York (1981). Page | 41
5. Mikell P, Grover and E Mory, "*Computer Aided Design and Manufacturing*", Prentice Hall of India
6. Mehta P V and Bhardwaj S K, " *Managing Quality in apparel industry*", Om Book Service, New Delhi
7. Cooklin Gerry, "*Garment Technology for Fashion Designers*", OM Book Service, New Delhi (1997).
8. Auto tex & Reach tech manuals

FREE ELECTIVE - II
6 FE TX 05 (ii) FASHION TECHNOLOGY
Section-A

Unit –I : Fashion Terms: Fashion, style, change, acceptance, taste. Fashion Evolution – fashion cycle, length of cycle consumer identification with fashion cycle, consumer group, fashion leaders, fashion innovators, fashion motivators or role model, fashion victims, fashion followers.

Unit –II : Adoption of fashion- Trickledown theory reverses adoption, mass dissemination. Motives for consumer buying, fashion selection, Aesthetic appeal, practical considerationsFashion categories-Womens wear, size range, styling and price range. mens wear ,price range styling, children wear- styling, size range, price range.

Unit-III : Fashion Research and Analysis- fashion forecasting, market research, consumer research, shopping, sales records, evaluating the collections, fashion services, fashion editing, design sources.

Section-B

Unit –IV: Fashion Concept: Principles of fashion, Fashion cycle, Theories of fashion leadership, Changes in fashion, Fashion terminology for merchandising. Fashion Promotion: Fashion Promotion, factors influencing fashion promotion, Publicity, fashion show, Personal selling and communication process.

Unit –V : Fashion Marketing: Marketing concepts, fashion marketing, role of fashion marketer, market segmentation, Fashion marketing planning, Mass marketing, Marketing management, Franchising and goal of merchandiser and pricing policies.

Unit –VI : Fashion Buying: Interpreting customer demand, Developing fashion images, Analyzing and selection of resources. Buying in domestic & foreign market. Consumer Behavior: Psychological, Social, Economical, Practical, Family Background and other.

Reference Books:

1) Concept of Consumer, Stephen Fringes, Fairchild Publication.
2) Fashion Merchandising, Stephen Fringes, Stone and samples publisher.
3) Creative fashion presentation, Polly Guerin, Stone and samples publisher.
4) Fashion Marketing, Easey, Stone and samples publisher.
5) Fashion Advertising and Promotion, Winter& Standlay Goodman, Stone and samples publisher.
6) Fashion from concept to consumer – Gini Stephens Frings.
7) Elements of fashion and appreal design.

6 TX 07 Minor Project

6 TX 08 Fabric Structure - II Lab
10 to 12 Practicals based on syllabus of 6 TX 01

6 TX 09 Advance Yarn Manufacturing Technology - Lab
8 to 10 Practicals based on syllabus of 6 TX 02

6 TX 10 Textile Testing II - Lab
10 to 12 Practicals based on syllabus of 6 TX 03

6 TX 11 Communication Skill - Lab
10 to 12 Practicals based on syllabus of 6 TX 06

FOUR YEAR DEGREE COURSE IN COMPUTER SCIENCE & ENGINEERING FIFTH SEMESTER (CREDIT & GRADE SYSTEM)

5KS01/ 5KE01 DATA COMMUNICATION

Unit I: Introduction: Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology Transmission mode, analog and digital signals, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals. **08Hrs**

Unit II: Encoding and modulating: digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems. Transmission media: guided media, unguided media, and transmission impairment. Performance, wavelength, Shannon capacity, media comparison. **8Hrs**

Unit III : Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system , Error detection and correction : types of errors, detection , VRC, Longitudinal redundancy check, cyclic redundancy check, checksum, error correction. **08Hrs**

Unit IV : Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit - oriented protocols, link access procedures. **08Hrs**

Unit V : Local Area Networks: Ethernet, other Ethernet networks, token bus, token ring, FDDI, Comparison, IEEE802.6 (DQDB) SMDS, Switching: circuit switching, packet switching, message switching, integrated services digital networks (ISDN): services, history, subscriber access to ISDN. **08Hrs**

Unit VI: Frame relay: introduction, frame relay operation, frame relay layers, congestion control, leaky bucket algorithm, traffic control, and other features. **08Hrs**

Text Book:
Behrouz A. Forouzan: Data Communication and Networking, (2/e) (TMH)

Reference Books:
1. William Stallings: Data & Computer Communications, 6/e, Pearson Education.
2. William L. Schweber : Data Communication, McGraw Hill.
3. J.Freey : Computer Communication & Networks, AEW Press.
4. D. Corner : Computer Networks & Internet, Pearson Education.

5KS02 /5KE02 FILE STRUCTURES & DATA PROCESSING

UNIT I : Introduction: File structure design, File processing operations : open, close, read, write, seek. Unix directory structure. Secondary storage devices: disks, tapes, CD-ROM. Buffer management. I/O in Unix. **08 Hrs**

UNIT II : File Structure Concepts: Field & record organization, Using classes to manipulate buffers, Record access, Record structures, file access & file organization, Abstract data models for file access. Metadata. Extensibility, Portability & standardization. **08 Hrs**

UNIT III: Data Compression, Reclaiming spaces in files, Introduction to internal sorting and Binary searching. Keysorting. Indexing concepts. Object I/O. Multiple keys indexing. Inverted lists, Selective indexes, Binding. **08 Hrs**

UNIT IV : Cosequential processing : Object-Oriented model, its application. Internal sorting: a second look. File Merging : Sorting of large files on disks. Sorting files on tapes. Sort merge packages. Sorting and Cosequential processing in Unix. **08 Hrs**

UNIT V: Multilevel indexing : Indexing using Binary Search trees. OOP based B-trees. B-tree methods Search, Insert and others. Deletion, merging & redistribution. B*trees. Virtual B-trees. VL records & keys. Indexed sequential file access and Prefix B+trees. **08 Hrs**

UNIT VI: Hashing : Introduction, a simple hashing algorithm. Hashing functions and record distributions. Collision resolution. Buckets. Making deletions. Pattern of record access. External hashing. Implementation. Deletion. Performance. Alternative approaches. **08 Hrs**

Text Book: Michael J.Folk, Bill Zoellick, Greg Riccard :File Structures : An Object-Oriented Approach using C++. (Addison-Wesley) (LPE)

Reference Books:
1. M, Loomis: “Data Management & File Processing” (PHI)
2. O.Hanson: “Design of Computer Data Files” McGraw-Hill (IE)
3. D. E. Knuth: “ The Art of Computer Programming”, Volume 3, (Addison Wesley).
4. James Bradly: “ Files and Database Techniques”, (Mc Graw Hill).

5KS03 /5KE03 SYSTEM SOFTWARE

Unit I : Introduction to Compiling: Phases of a compiler, Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, and language for specifying lexical analysis, lex and yacc tools, state minimization of DFA. **08 Hrs**

Unit II : Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Error recovery in predictive parsing. **08 Hrs**

Unit III: Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing. **08 Hrs**

Unit IV: Syntax Directed Translation: Syntax directed definitions, attributes, dependency graphs, construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator. **08 Hrs**

Unit V : Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, subdivision of run time memory, activation records, Storage allocation strategies, static allocation, stack allocation, dangling references. Symbol table: Entries, Storage allocation, Hash tables, Scope information. **08 Hrs**

Unit VI: Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. **08 Hrs**

Text Book:

A V Aho, R Sethi, J D Ullman "Compilers Principles, Techniques and Tools", Pearson Education (LPE).

Reference Books:

1. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India
2. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
3. K C. Louden "Compiler Construction—Principles and Practice" India Edition, CENGAGE
4. Bennett J.P., "Introduction to Compiling Techniques", 2/e (TMH).

5KS04 /5KE04 SWITCHING THEORY AND LOGIC DESIGN

Unit I : VHDL Modeling Concepts, VHDL Fundamentals: Constants, Variables, Scalar types, Type Classification, Expressions, Operators, Sequential Statements, If, Case, Null, Loop, Assertion, Reports statements. **08 Hrs**

Unit II : Array & VHDL, Unconstrained array types, Array operations & referencing, Records Basic Modeling constructs: Entity declarations, Architecture bodies, Behavioral descriptions, Structural descriptions, Design processing, Sub Programs and Procedures. **08 Hrs**

Unit III : Minimization of Switching Function: Review of Karnaugh-map up to four variables, Limitation of K-Maps, Implementation of Logic Functions, Nondegenerate Forms, Quine – McCluskey Method. **08 Hrs**

Unit IV : Combinational Logic Design: Introduction, Design Procedure, Adders, Subtractors, Binary Parellel Adder, 4-bit Parallel Subtractor, Binary Adder-Subtractor, The Look-ahead-carry Adder, 2's Complement Addition and subtraction Using Parallel Adders. **08 Hrs**

Unit V : Serial Adder, BCD Adder, Excess-3 Adder and Subtractor, Binary Multipliers, Code Converters, Parity Bit Generators/Checkers, Comparators, IC Comparator, Encoders, Keyboard Encoders, Decoders, Multiplexers. **08 Hrs**

Unit VI : Sequential Circuits Design: Conversion of Flip-Flops, Design of Synchronous, Asynchronous Counters and Shift Register Counters. Finite State Machine, Mathematical Representation of Synchronous Sequential machine, Mealy and Moore Model. **08 Hrs**

Text Book:

1. Peter J. Ashenden, "The Designer's Guide to VHDL", 2nd Edn, Harcourt Asia
2. Anand Kumar "Switching Theory and Logic Design" (PHI)

Reference Books:

1. J.F. Wakerly, "Digital Logic Design", PHI.
2. V.P. Nelson Et al, "Digital Logic Circuits, Analysis & Design", PHI.
3. Moris Mano & Kime."Logic and Computer Design Fundamentals" Pearson Education.
4. J. Bhaskar, "VHDL Primer", Person Education

FREE ELECTIVE-I
5FEKS05 (i) DATA STRUCTURES & ALGORITHMS

Unit I : Data structures basics, Mathematical /algorithmic notations & functions, Complexity of algorithms, Sub-algorithms. String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms. **08Hrs.**

Unit-II : Linear arrays and their representation in memory, traversing linear arrays, inserting & deleting operations, Bubble sort, Linear search and Binary search algorithms. Multi-demensional arrays, Pointer arrays. Record structures and their memory representation. Matrices and sparse matrices. **08Hrs.**

Unit-III: Linked lists and their representation in memory, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion deletion operations on linked lists. Header linked lists, Two- way linked lists. **08Hrs.**

Unit-IV: Stacks and their array representation. Arithmetic expressions: Polish notation. Quick sort, application of stacks. Implementation of recursive procedures by stacks, Queues. Deques. Priority queues. **08Hrs.**

Unit-V : Trees, Binary trees & and their representation in memory, Traversing binary trees. Traversal algorithms using stacks, Header nodes : threads. Heap and heapsort. Path length & Huffman's algorithm. General trees. **08Hrs.**

Unit-VI : Graph theory, sequential representations of graphs, Warshalls' algorithm, Linked representation, operations & traversing the graphs. Posets & Topological sorting. Insertion Sort, Selection Sort. Radix sort. **8Hrs.**

Text Book:

Seymour Lipschutz: "Data Structures with C", Schaum's Outline Series.

Reference Books:

1. Forouzan, Gilberg: Data Structures and Algorithms, CENGAGE Learning.
2. Reema Thareja: Data Structures using C, Oxford University Press, 2011.
3. Arpita Gopal: Magnifying Data structures, PHI (EEE), 2010.
4. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.

FREE ELECTIVE-I
5FEKS05 (ii) DATA COMMUNICATION AND NETWORKING

Unit I : Introduction: Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology, Transmission mode, analog and digital signals, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals.

Unit II : Encoding and modulating: digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems, transmission media: guided media, unguided media, transmission impairment.

Unit III : Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system , Error detection and correction : types of errors, detection , cyclic redundancy check, checksum, error correction.

Unit IV: Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit - oriented protocols.

Unit V : Local Area Networks: Ethernet, other Ethernet networks, token bus, token ring, FDDI, Comparison, MAN: IEEE802.6 (DQDB) SMDS, Switching: circuit switching, packet switching, message switching.

UNIT VI: Networking and Internetworking Devices: Repeaters, Bridges, Routers, Gateways. Transport Layer: Functions of transport layer, connection, the OSI transport protocol, upper OSI Layer: Session layer, presentation layer, Application Layer.

Text Book:

Behrouz A. Forouzan: Data Communication and Networking, (2/e), TMH.

Reference Books:

1. William Stallings: Data & Computer Communications, (6/e) Pearson Education.

2. William L. Schweber : Data Communication, McGraw Hill.

3. J.Freey : Computer Communication & Networks, AEW Press.

4. D. Comer : Computer Networks & Internet, Pearson Education.

5KS06 / 5KE06 COMMUNICATION SKILLS

Unit I: Introduction to Communication: Introduction- Importance of Communication, Basics of Communication, Purpose and Audience, Cross-cultural Communication, Language As a tool of communication, Communicative Skills-LSRW, Effective Communication, Modes of Communication, Importance of Technical Communication, Barriers to Communication: Introduction, Classification of Barriers, Information Gap Principle-Given and New Information, Filters, Basics of Technical Communication: Introduction, Objective and Characteristics of Technical Communication, Process of Communication, Levels of Communication, Flow of Communication, Communication Networks, Visual Aids in Technical Communication

Unit II : Active Listening: Introduction, Reason for poor Listening, Traits of a Good Listener, Listening Modes, Types of Listening, Barriers to Effective Listening, Listening for General Content and Specific Information, Effective Speaking: Introduction, Achieving Confidence, Clarity, and Fluency, Paralinguistic Features, Barriers to Speaking, Types of Speaking, Persuasive Speaking, Public Speaking, Listening and Speaking: Introduction, Conversations, Telephonic Conversations and Etiquette, Dialogue Writing, Effective Presentation Strategies: Introduction, Planning, Outlining and Structuring, Nuances of Delivery, Controlling Nervousness and Stage Fright, Visual Aids in Presentations, Application of Ms PowerPoint, Interviews: Introduction, Objectives of Interviews, Types of Interviews, Job Interviews, Media Interviews, Press Conferences, Group Communication: Introduction, Forms of Group Communication, Use of Body Language in Group Communication, Discussions.

Unit III : Reading: Introduction, Reading Rates, Reading and Interpretation, Intensive and Extensive Reading, Critical Reading, Reading for different Purposes, Reading Comprehension, Reading Techniques: Introduction, Improving Comprehension Skills, Techniques for Good Comprehension, General Kitchen Layout, Predicting the Content, Understanding the Gist, SQ3R Reading technique, Study Skills, Technical Writing: Introduction, Audience Recognition/Analysis, Language, Elements of Style, Techniques for Good Technical Writing, Reports: Introduction, Characteristics of a Report, Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscripts format), Types of Report, Technical Proposals: Introduction, Definition and Purpose, Types, Characteristics, Structure of Proposals, Style and Appearance, Evaluation of Proposals, Research Paper, Dissertation, Thesis.

Text Book:

Raman & Sharma: "Technical Communication Principles & Practice" (2/e) Oxford University Press.

Reference Books:

1. M Ashraf Rizvi: " Effective Technical Communication" Mc Graw Hill.
2. Mohan, Banerjee: "Developing Communication Skills",MacMillan India Limited.
3. ChrissieWright(Editor): "Handbook of Practical Communication Skills", Jaico Publishing House.
4. CDC, TTTI WR, Bhopal: "A Course in Technical English, Somaiya Publication Pvt. Ltd."
5. F.Frank Candlin: "General English for Technical Students", University of London Press Ltd.

5KS07 System Software Lab.: Minimum Eight experiments/ programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

5KS08 Switching Theory & Logic Design Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus covering each of the units. Design Practical examples should be based on Unit III to Unit VI using VHDL.

5KS09 Communication Skills Lab.: Minimum Eight experiments/ programming assignments must be completed based on the respective syllabus as follows.

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building, Phonetics.
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

Reference Book: Norman Lewis: Word Power Made Easy
Website: http://www.teachingenglish.org.uk

6KS01/ 6KE01 OPERATING SYSTEMS

Unit-I : Introduction: Operating System(OS) definition, OS Evolution, OS Components, OS Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication, Threads: Multithreading Models, Threading Issues, Java Threads.

Unit-II: CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Monitors. Deadlocks: Definition & Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock. **08 Hrs**

Unit-III: Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging. Virtual Memory: Background, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing. **08 Hrs**

Unit-IV: File-System Interface: Directory Structure, File-System Mounting, File Sharing, Protection. File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, File Recovery. **08 Hrs**

Unit-V : I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. **08 Hrs**

Unit-VI: The Linux System: History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File systems, Input and Output, Inter process Communication, Network Structure & Security in Linux. **08Hrs**

Text Book:
Avi Silberschatz ,P.B.Galvin, G.Gagne: “Operating System Concepts” (6/e) John-Wiley & Sons.

Reference Books:
1. A.S Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D M Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P.Balkrishna Prasad: “Operating Systems” Scitech Pubications(I) Pvt. Ltd.

6KS02 / 6KE02 DATABASE SYSTEMS

Unit-I : Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application architectures, History of Database Systems. Entity- Relationship Model, Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema, Reduction of an E-R Schema to Tables. **08Hrs**

Unit-II: Relational Model: Structure of Relational Databases, The Relational Algebra, Extended Relational-Algebra Operations, Modification of the Database, Views, The Tuple Relational Calculus, The Domain Relational Calculus, SQL: Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Subqueries, Views. **08Hrs**

Unit-III: Integrity and Security, Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication, Relational-Database Design:, First Normal Form, Pitfalls in Relational-Database, Design, Functional Dependencies, Decomposition, BCNF, Third, Fourth and more Normal Forms, Overall Database Design Process. **08 Hrs**

Unit-IV: Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views. **08Hrs**

Unit-V : Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability. **08Hrs**

Unit-VI: Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularities, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations Weak Levels of Consistency, Concurrency in Index Structures. Recovery System: issues & solutions. **08Hrs**

Text Book:

Silberschatz, Korth, Sudarshan: "Database System Concepts" , (5th Edition)McGraw Hill,

Reference Books:

1. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
2. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
3. G.K. Gupta: Database Management Systems, McGraw Hill.
4. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

6KS03 / 6KE03 COMPUTING RESOURCES MANAGEMENT

Unit-I : Systems Management: Definition, Building a Business Case for Systems Management, Organizing for Systems Management, Factors to Consider in Designing IT Organizations and Infrastructure. Staffing for Systems Management, IT as Service, and IT Service Management.

Unit-II : Availability, Methods for Measuring Availability, Seven ' Rs' of High Availability. Performance and Tuning, Definition and characteristics. Performance and Tuning Applied to the Five Major Resource Environments. Problem Management: Definition and scope. Key Steps to Developing a Problem Management Process.

Unit-III : Storage Management: Definition, Desired Traits, Capacity, Performance, Reliability, Recoverability.Network Management: Definition, Key Decisions about Network Management, Assessing, Measuring and Streamlining an Infrastructure's Network Management Process.

Unit-IV : Configuration Management, Definition, Practical Tips for Improving Configuration Management. Capacity Planning: Definition, reasons for poor Capacity Planning, Developing an Effective Capacity Planning Process, Benefits and hints for effective capacity planning.

Unit-V : Strategic Security: Definition, Developing a Strategic Security Process, Assessing, Measuring and Streamlining the Security Process. Facilities Management: Definition, Major Elements, Tips, Assessing, Measuring and Streamlining the Facilities Management Process.

Unit-VI: Developing Robust Processes: Features of World-Class Infrastructure. Characteristics of a Robust Process. Integrating Systems Management Processes. Client-Server Environment Issues. Web-Enabled Environment Issues.

Text Book:

Ritch Schiesser "IT Systems Management", 2nd Edition, Prentice Hall.

Reference Books :

1. Bill Holtsnider, Brian Jaffe, Brian D Jaffe "IT Managers Handbook" (2/e) Morgan Kaufmann.
2. Jan Van Bon,et.el.,"Foundation of IT Service Management Based on ITIL V3" Van Haren.
3. Harrise Kern, Rich Schiesser " IT Systems Management", 1st Edition, Prentice Hall.

6KS04 / 6KE04 COMPUTER ARCHITECTURE

Unit I : Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Types.
08 Hrs

Unit II: Instruction Sets: Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language. **08Hrs**

Unit III : Processor Structure and Function: Processor Organization, Register Organization, The Instruction Cycle, Instruction Pipelining, The x86 Processor Family, The ARM Processor. **08 Hrs**

Unit IV: Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, The Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining. RISC versus CISC. **08 Hrs**

Unit V : Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, Microprogrammed control, Basic Concepts, Microinstruction Sequencing & Execution. **08Hrs**

Unit VI : Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization. **08 Hrs**

Text Book:

William Stallings: "Computer Organization and Architecture", (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: "Computer Architecture", Oxford University Press.

2. J.P. Hayes: "Computer Architecture and Organization" ,McGraw Hill.
3. D.A. Patterson, J.L. Hennessy: "Computer Architecture" Morgan Kauffmann, 2002.
4. Hwang and Briggs: "Computer Architecture and Parallel Processing" McGraw-Hill.

6FEKS05 FREE ELECTIVE-II
(i) DATABASE MANAGEMENT SYSTEMS

Unit-I : Introduction: Database System Applications, Purpose of Database Systems, and View of Data, Database Languages, Database Architecture, Database Users and Administrators. Relational Model: Structure of Relational Databases, Fundamentals of Relational-Algebra.

Unit-II : SQL: Background, Data Definition, Basic Structure of SQL queries, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Complex Queries, Views, Modification of Database, Joined relations. SQL Data Types and Schemas, Integrity Constraints, Authorization.

Unit-III: Database Design: Overview of the Design Process, Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Reduction to Relational Schemas. Relational Database Design: Atomic Domains, Normalization and Normal Forms, Functional Dependencies, Decomposition using Functional Dependencies.

Unit-IV : Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions. Query Optimization: Overview, Transformation of Relational Expressions, Materialized Views.

Unit-V : Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Testing for Serializability.

Unit-VI : Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Weak Levels of Consistency, Recovery System: Failure Classification, Recovery and Atomicity, Log-Based Recovery.

Text Book :

Silberschatz, Korth, Sudarshan: "Database System Concepts", (5/e) McGraw Hill.

Reference Books:

1. Raghu Ramkrishnan, Johannes Gherke: Database Management Systems, TMH.
2. C.J.Date: Introduction to Database Systems, Pearson Education.
3. Connolly & Begg: Database System, Low Price Ed.
4. El-Maseri, Navathe: Fundamentals of Database Systems, Pearson Education.

6FEKS05 FREE ELECTIVE-II
(ii) SOFTWARE PROJECT MANAGEMENT

Unit I: Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. WSHH principle, critical practice.

Unit II : Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

Unit III: Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV : System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User-interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

Unit VI: Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

Textbook:

Pressman Roger. S: "Software Engineering, A Practitioner's Approach", TMH.

Reference Books :

1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Davis A: Principles of Software Development (McGraw Hill)
3. Jawadekar W.S.: Software Engineering Principles and Practice, Mc Graw Hill.
4. Jalote Pankaj: An Integrated Approach to Software Engineering, Narosa Publications.

6KS06 / 6KE06 PROFESSIONAL ETHICS

Unit I : Introduction: Computers in a Social Context. Moral and Legal Issues. Computer Ethical Issues. Philosophical Ethics: Descriptive and Normative Claims, Ethical Relativism, Utilitarianism, Deontological Theories, Rights, Virtue Ethics, Individual and Social Policy Ethics. Professional Ethics: Characteristics and system of Professions, Computing as Profession, Professional Relationships, Conflicting Responsibilities, Code of Ethics and Professional Conduct, Collective Responsibility. **08 Hrs**

Unit II : Ethics and The Internet: Three Morally Significant Characteristics, Hacking and Hacker Ethics, New Species of Old Crime, Netiquette, And Policy Approaches. Computers and Privacy issues, Legislative Background, Global Perspective, Proposals for Better Privacy Protection. Property Rights in Computer Software: Definitions, Current Legal Protection, Philosophical basis and analysis of Property, Proprietary Software, and Software Copying. **08 Hrs**

Unit III : Accountability, Computer and Information Technology: Different Senses of Responsibility, Buying and Selling Software, Y2K Problem, Diffusion of Accountability, Internet Issues, ISP Liability, and Virtual Action. Technology and Social change, Embedded Values, Enhanced and Impeded Values, Democratic Values in the Internet, Internet as Democratic Technology, Access and the Digital Divide, Free Expression, Overarching and Future Issues. **08Hrs**

Text Book:

Deborah G. Johnson: "Computer Ethics" Pearson Education (Third Edition).

Reference Books:

1. George Reynolds: "Ethics in Information Technology" Cengage Learning.
2. Hester and Ford: "Computers and Ethics in the Cyberage.
3. Duncan Langford: "Internet Ethics"
4. Richard A. Spinello: "Case Studies in Information Technology Ethics" PHI.

6KS07 Operating Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

6KS08 Database Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units along with one mini project.

6KS09 Computer Lab-II (Hardware Lab): This lab is based on PC organization, troubleshooting & maintenance.

Student should perform practical on the following areas of PC:

1. PC models.
2. Inside the PC.
3. Preventive maintenance.
4. PC troubleshooting.
5. Semiconductor memories
6. Power supplies & power protection
7. Hard Disks: installing, configuring & maintenance
8. SCSI drives
9. Printers & their troubleshooting
10. Modems & serial interfaces, USB's and Devices.
11. Keyboard, Mice, Video adapters & displays
12. Sound boards, Video capture & CD ROMs.
13. Study of PC Ports & Interfacing Cards.

Books :

1. Mark Minasi : Complete PC upgrade & Maintenance Guide (BPB)
2. Scott Muller: Upgrading and Repairing PCs 12/e (Que)

FOUR YEAR DEGREE COURSE IN COMPUTER ENGINEERING FIFTH SEMESTER (CREDIT & GRADE SYSTEM)

5KE01 DATA COMMUNICATION

Unit I: Introduction: Components, Networks, Protocols and standards, Basic Concepts: Line Configuration, Topology Transmission mode, analog and digital signals, periodic and aperiodic signals, analog signals, time and frequency domains, composite signals, digital signals. **08Hrs**

Unit II: Encoding and modulating: digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion, digital data transmission, DTE-DCE interface, modems, cable modems. Transmission media: guided media, unguided media, and transmission impairment. Performance, wavelength, Shannon capacity, media comparison. **8Hrs**

Unit III : Multiplexing: Many to one/ one to many, frequency division multiplexing, wave division multiplexing, TDM, multiplexing applications: the telephone system , Error detection and correction : types of errors, detection , VRC, Longitudinal redundancy check, cyclic redundancy check, checksum, error correction. **08Hrs**

Unit IV : Data link Control: Line Discipline, flow control, error control, Data link Protocols: Asynchronous Protocols, synchronous protocols, character oriented protocols, bit - oriented protocols, link access procedures. **08Hrs**

Unit V : Local Area Networks: Ethernet, other Ethernet networks, token bus, token ring, FDDI, Comparison, IEEE802.6 (DQDB) SMDS, Switching: circuit switching, packet switching, message switching, integrated services digital networks (ISDN): services, history, subscriber access to ISDN. **08Hrs**

Unit VI: Frame relay: introduction, frame relay operation, frame relay layers, congestion control, leaky bucket algorithm, traffic control, and other features. **08Hrs**

Text Book:

Behrouz A. Forouzan: Data Communication and Networking, (2/e) (TMH)

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education.
2. William L. Schweber : Data Communication, McGraw Hill.
3. J.Freey : Computer Communication & Networks, AEW Press.
4. D. Corner : Computer Networks & Internet, Pearson Education.

5KE02 FILE STRUCTURES & DATA PROCESSING

UNIT I : Introduction: File structure design, File processing operations : open, close, read, write, seek. Unix directory structure. Secondary storage devices: disks, tapes, CD-ROM. Buffer management. I/O in Unix. **08 Hrs**

UNIT II : File Structure Concepts: Field & record organization, Using classes to manipulate buffers, Record access, Record structures, file access & file organization, Abstract data models for file access. Metadata. Extensibility, Portability & standardization. **08 Hrs**

UNIT III: Data Compression, Reclaiming spaces in files, Introduction to internal sorting and Binary searching. Keysorting. Indexing concepts. Object I/O. Multiple keys indexing. Inverted lists, Selective indexes, Binding. **08 Hrs**

UNIT IV : Cosequential processing : Object-Oriented model, its application. Internal sorting: a second look. File Merging : Sorting of large files on disks. Sorting files on tapes. Sort merge packages. Sorting and Cosequential processing in Unix. **08 Hrs**

UNIT V: Multilevel indexing : Indexing using Binary Search trees. OOP based B-trees. B-tree methods Search, Insert and others. Deletion, merging & redistribution. B*trees. Virtual B-trees. VL records & keys. Indexed sequential file access and Prefix B+trees. **08 Hrs**

UNIT VI: Hashing : Introduction, a simple hashing algorithm. Hashing functions and record distributions. Collision resolution. Buckets. Making deletions. Pattern of record access. External hashing. Implementation. Deletion. Performance. Alternative approaches. **08 Hrs**

Text Book: Michael J.Folk, Bill Zoellick, Greg Riccard :File Structures : An Object-Oriented Approach using C++. (Addison-Wesley) (LPE)

Reference Books:

1. M, Loomis: “Data Management & File Processing” (PHI)
2. O.Hanson: “Design of Computer Data Files” McGraw-Hill (IE)
3. D. E. Knuth: “ The Art of Computer Programming”, Volume 3, (Addison Wesley).
4. James Bradly: “ Files and Database Techniques”, (Mc Graw Hill).

5KE03 SYSTEM SOFTWARE

Unit I : Introduction to Compiling: Phases of a compiler, Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, and language for specifying lexical analysis, lex and yacc tools, state minimization of DFA. **08 Hrs**

Unit II : Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Error recovery in predictive parsing. **08 Hrs**

Unit III: Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing. **08 Hrs**

Unit IV: Syntax Directed Translation: Syntax directed definitions, attributes, dependency graphs, construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator. **08 Hrs**

Unit V : Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, subdivision of run time memory, activation records, Storage allocation strategies, static allocation, stack allocation, dangling references. Symbol table: Entries, Storage allocation, Hash tables, Scope information. **08 Hrs**

Unit VI: Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. **08 Hrs**

Text Book:

A V Aho, R Sethi, J D Ullman "Compilers Principles, Techniques and Tools", Pearson Education (LPE).

Reference Books:

1. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India
2. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press

3. K C. Louden "Compiler Construction—Principles and Practice" India Edition, CENGAGE
4. Bennett J.P., "Introduction to Compiling Techniques", 2/e (TMH).

5KE04 SWITCHING THEORY AND LOGIC DESIGN

Unit I : VHDL Modeling Concepts, VHDL Fundamentals: Constants, Variables, Scalar types, Type Classification, Expressions, Operators, Sequential Statements, If, Case, Null, Loop, Assertion, Reports statements. **08 Hrs**

Unit II : Array & VHDL, Unconstrained array types, Array operations & referencing, Records Basic Modeling constructs: Entity declarations, Architecture bodies, Behavioral descriptions, Structural descriptions, Design processing, Sub Programs and Procedures. **08 Hrs**

Unit III : Minimization of Switching Function: Review of Karnaugh-map up to four variables, Limitation of K-Maps, Implementation of Logic Functions, Nondegenerate Forms, Quine – McCluskey Method. **08 Hrs**

Unit IV : Combinational Logic Design: Introduction, Design Procedure, Adders, Subtractors, Binary Parellel Adder, 4-bit Parallel Subtractor, Binary Adder-Subtractor, The Look-ahead-carry Adder, 2's Complement Addition and subtraction Using Parallel Adders. **08 Hrs**

Unit V : Serial Adder, BCD Adder, Excess-3 Adder and Subtractor, Binary Multipliers, Code Converters, Parity Bit Generators/ Checkers, Comparators, IC Comparator, Encoders, Keyboard Encoders, Decoders, Multiplexers. **08 Hrs**

Unit VI : Sequential Circuits Design: Conversion of Flip-Flops, Design of Synchronous, Asynchronous Counters and Shift Register Counters. Finite State Machine, Mathematical Representation of Synchronous Sequential machine, Mealy and Moore Model. **08 Hrs**

Text Books:

1. Peter J. Ashenden, "The Designer's Guide to VHDL", 2nd Edn, Harcourt Asia
2. Anand Kumar "Switching Theory and Logic Design" (PHI)

Reference Books:

1. J.F. Wakerly, "Digital Logic Design", PHI.
2. V.P. Nelson Et al, "Digital Logic Circuits, Analysis & Design", PHI.
3. Moris Mano & Kime."Logic and Computer Design Fundamentals" Pearson Education.
4. J. Bhaskar, "VHDL Primer", Person Education

FREE ELECTIVE-I
5FEKE05 (i) WEB TECHNOLOGIES

UNIT I: Introduction to the Web: History, Creating Websites, web applications, writing web projects, identification of objects, target users, web team. Web architecture: web servers, web browsers, TCP/IP protocol suite, IP Address, MIME. Hypertext Transfer Protocol (HTTP): Introduction, Resources, URL anatomy, Message Format, Examples, Web caching, Proxy. **08Hrs**

Unit II: Hypertext Markup language (HTML): History of HTML, HTML & its flavors, HTML basics, Elements, attributes and tags of HTML, Basic Tags, Advanced Tags, Frames, Images, Meta Tag, Planning of web page, Model and Structure of web site, Designing web pages, Multimedia content. **08Hrs**

Unit III: Cascading Style Sheet (CSS): Introduction, advantages, Adding CSS, Browser compatibility, CSS and page layout, Selectors, Grouping, and Type Selectors. Extensible Markup Language (XML): Common Usage, Role of XML, Prolog, Body, Elements, Attributes, Validation, Displaying XML, Namespaces. **08 Hrs**

Unit IV: XML DTD: Introduction to DTD, Purpose of DTD, DTD in XML document, Element type declaration, Attribute declaration, Entity declaration, DTD validation. XML Schema: Introduction, comparison with DTD, schema structure, schema element, element declaration, schema validation, built in data types, declaring simple elements. **08Hrs**

Unit V: Java Script: Introduction, variables, literals, operators, control structure, conditional statements, Arrays, Functions, Parameter Passing, Function Pointer, Inner/Nested Functions, and Objects. Client side programming. **08Hrs**

Unit VI: Common Gateway Interface (CGI): Internet programming paradigm, Server side programming with JavaScript, Language for CGI, Applications, Server environment, Environment variables, CGI building blocks, CGI scripting using JavaScript, Shell script, writing CGI program, CGI security, alternatives and enhancement in CGI. **08 Hrs**

Text Book:

Roy Uttam K: Web Technologies, Oxford University Press, 2010.

Reference Books:

1. Dr. Raja Subramanian: Creating Web Sites in Engineering,University Science Press.
2. Mohler J.L. & Duff J.M.: Desiginig Interactive Web Sites, CENGAGE Learning.
3. Joel Sklar: Text Book of Web Design, CENGAGE Learning.
4. Meenakshi G.M.: Web Graphics, Scitech Publications(India) Pvt. Ltd.

FREE ELECTIVE-I
5FEKE05 (ii) OBJECT ORIENTED PROGRAMMING

Unit I: Objects & Classes in C++: Declaring & using classes, Constructors, Objects as function arguments, Copy Constructors, Static class data, Arrays of Objects, C++ String class.

Unit II: Operator Overloading: Overloading Unary & Binary Operators, Data Conversion, Pitfalls of Operator Overloading, Pointers & Arrays, Pointers & Functions, New & Delete Operators, Pointers for Objects.

Unit III: Inheritance in C++: Derived Class & Base Class, Derived class Constructors, Function overloading, Class hierarchies, Public & Private Inheritance, Multiple Inheritance, Containership: Classes within Classes.

Unit IV: Virtual Function Concepts: Abstract Classes & Pure Virtual Functions, Virtual Base classes, Friend functions, Static Functions, Assignment & copy initialization, the this pointer, Dynamic type information.

Unit V: Streams & Files in C++: Stream Classes, stream errors, disk file I/O with streams, File Pointers, Error handling in file I/O, File I/O with member functions, overloading the extractions & Insertions operator, Command Line Arguments, Multi-file programs.

Unit VI: Function Template, Class template, Exception Syntax, Multiple exceptions, Exception with Arguments, Introduction to Standard Template Library, Algorithms, Sequential Containers. Function objects.

Text Book:

Robert Lafore: Object Oriented Programming in C++, Galgotia Publication.

Reference Books:

1. Herbert Schildt: C++: Complete Refernce,TMH.
2. Bjarne Stroustrupe: C++ Programming Language, Addision Wesley.

3. Venugopal: Mastering C++, TMH.

4. Lipmann: C++ Primer, Addision Wesley.

5KE06 COMMUNICATION SKILLS

Unit I: Introduction to Communication: Introduction- Importance of Communication, Basics of Communication, Purpose and Audience, Cross-cultural Communication, Language As a tool of communication, Communicative Skills-LSRW, Effective Communication, Modes of Communication, Importance of Technical Communication, Barriers to Communication: Introduction, Classification of Barriers, Information Gap Principle-Given and New Information, Filters, Basics of Technical Communication: Introduction, Objective and Characteristics of Technical Communication, Process of Communication, Levels of Communication, Flow of Communication, Communication Networks, Visual Aids in Technical Communication

Unit II : Active Listening: Introduction, Reason for poor Listening, Traits of a Good Listener, Listening Modes, Types of Listening, Barriers to Effective Listening, Listening for General Content and Specific Information, Effective Speaking: Introduction, Achieving Confidence, Clarity, and Fluency, Paralinguistic Features, Barriers to Speaking, Types of Speaking, Persuasive Speaking, Public Speaking, Listening and Speaking: Introduction, Conversations, Telephonic Conversations and Etiquette, Dialogue Writing, Effective Presentation Strategies: Introduction, Planning, Outlining and Structuring, Nuances of Delivery, Controlling Nervousness and Stage Fright, Visual Aids in Presentations, Application of Ms PowerPoint, Interviews: Introduction, Objectives of Interviews, Types of Interviews, Job Interviews, Media Interviews, Press Conferences, Group Communication: Introduction, Forms of Group Communication, Use of Body Language in Group Communication, Discussions.

Unit III : Reading: Introduction, Reading Rates, Reading and Interpretation, Intensive and Extensive Reading, Critical Reading, Reading for different Purposes, Reading Comprehension, Reading Techniques: Introduction, Improving Comprehension Skills, Techniques for Good Comprehension, General Kitchen Layout, Predicting the Content, Understanding the Gist, SQ3R Reading technique, Study Skills, Technical Writing: Introduction, Audience Recognition/Analysis, Language, Elements of Style, Techniques for Good Technical

Writing, Reports: Introduction, Characteristics of a Report, Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscripts format), Types of Report, Technical Proposals: Introduction, Definition and Purpose, Types, Characteristics, Structure of Proposals, Style and Appearance, Evaluation of Proposals, Research Paper, Dissertation, Thesis.

Text Book:

Raman & Sharma: “Technical Communication Principles & Practice” (2/e) Oxford University Press.

Reference Books:

1. M Ashraf Rizvi: “ Effective Technical Communication” Mc Graw Hill.
2. Mohan, Banerjee: “Developing Communication Skills”,MacMillan India Limited.
3. ChrissieWright(Editor): “Handbook of Practical Communication Skills”, Jaico Publishing House.
4. CDC, TTTI WR, Bhopal: “A Course in Technical English, Somaiya Publication Pvt. Ltd.”
5. F.Frank Candlin: “General English for Technical Students”, University of London Press Ltd.

5KE07 System Software Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

5KE08 Switching Theory & Logic Design Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus covering each of the units. Design Practical examples should be based on Unit III to Unit VI using VHDL.

5KE09 Communication Skills Lab.: Minimum Eight experiments/ programming assignments must be completed based on the respective syllabus as follows.

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation. The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building, Phonetics.
2. Technical report writing
3. Group discussions

4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

Reference Book: Norman Lewis: Word Power Made Easy
Website: http://www.teachingenglish.org.uk

6KE01 OPERATING SYSTEMS

Unit-I : Introduction: Operating System(OS) definition, OS Evolution, OS Components, OS Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication, Threads: Multithreading Models, Threading Issues, Java Threads. **08 Hrs**

Unit-II: CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms, Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Monitors. Deadlocks: Definition & Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock. **08 Hrs**

Unit-III: Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging. Virtual Memory: Background, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing. **08 Hrs**

Unit-IV: File-System Interface: Directory Structure, File-System Mounting, File Sharing, Protection. File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, File Recovery. **08 Hrs**

Unit-V : I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. **08 Hrs**

Unit-VI: The Linux System: History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File systems, Input and Output, Inter process Communication, Network Structure & Security in Linux. **08Hrs**

Text Book:
Avi Silberschatz ,P.B.Galvin, G.Gagne: "Operating System Concepts" (6/e) John-Wiley & Sons.

Reference Books:
1. A.S Tanenbaum "Modern Operating Systems" Pearson Education.
2. William Stallings "Operating Systems" Prentice-Hall.
3. D M Dhamdhere "Operating Systems" Tata McGraw-Hill.
4. P.Balkrishna Prasad: "Operating Systems" Scitech Pubications(I) Pvt. Ltd.

6KE02 DATABASE SYSTEMS

Unit-I : Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application architectures, History of Database Systems. Entity- Relationship Model, Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema, Reduction of an E-R Schema to Tables. **08Hrs**

Unit-II: Relational Model: Structure of Relational Databases, The Relational Algebra, Extended Relational-Algebra Operations, Modification of the Database, Views, The Tuple Relational Calculus, The Domain Relational Calculus, SQL: Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Subqueries, Views. **08Hrs**

Unit-III: Integrity and Security, Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication, Relational-Database Design:, First Normal Form, Pitfalls in Relational-Database, Design, Functional Dependencies, Decomposition, BCNF, Third, Fourth and more Normal Forms, Overall Database Design Process. **08 Hrs**

Unit-IV: Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views. **08Hrs**

Unit-V : Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability. **08Hrs**

Unit-VI: Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularities, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations Weak Levels of Consistency, Concurrency in Index Structures. Recovery System: issues & solutions. **08Hrs**

Text Book:

Silberschatz, Korth, Sudarshan: "Database System Concepts" , (5th Edition)McGraw Hill,

Reference Books:

1. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
2. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
3. G.K. Gupta: Database Management Systems, McGraw Hill.
4. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

6KE03 COMPUTING RESOURCES MANAGEMENT

Unit-I : Systems Management: Definition, Building a Business Case for Systems Management, Organizing for Systems Management, Factors to Consider in Designing IT Organizations and Infrastructure. Staffing for Systems Management, IT as Service, and IT Service Management.

Unit-II : Availability, Methods for Measuring Availability, Seven ' Rs' of High Availability. Performance and Tuning, Definition and characteristics. Performance and Tuning Applied to the Five Major Resource Environments. Problem Management: Definition and scope. Key Steps to Developing a Problem Management Process.

Unit-III : Storage Management: Definition, Desired Traits, Capacity, Performance, Reliability, Recoverability.Network Management: Definition, Key Decisions about Network Management, Assessing, Measuring and Streamlining an Infrastructure's Network Management Process.

Unit-IV : Configuration Management, Definition, Practical Tips for Improving Configuration Management. Capacity Planning: Definition, reasons for poor Capacity Planning, Developing an Effective Capacity Planning Process, Benefits and hints for effective capacity planning.

Unit-V : Strategic Security: Definition, Developing a Strategic Security Process, Assessing, Measuring and Streamlining the Security Process. Facilities Management: Definition, Major Elements, Tips, Assessing, Measuring and Streamlining the Facilities Management Process.

Unit-VI: Developing Robust Processes: Features of World-Class Infrastructure. Characteristics of a Robust Process. Integrating Systems Management Processes. Client-Server Environment Issues. Web-Enabled Environment Issues.

Text Book:

Ritch Schiesser "IT Systems Management", 2nd Edition, Prentice Hall.

Reference Books :

1. Bill Holtsnider, Brian Jaffe, Brian D Jaffe "IT Managers Handbook" (2/e) Morgan Kaufmann.
2. Jan Van Bon,et.el.,"Foundation of IT Service Management Based on ITIL V3" Van Haren.
3. Harrise Kern, Rich Schiesser " IT Systems Management", 1st Edition, Prentice Hall.

6KE04 COMPUTER ARCHITECTURE

Unit I : Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Types. **08 Hrs**

Unit II: Instruction Sets: Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language. **08Hrs**

Unit III : Processor Structure and Function: Processor Organization, Register Organization, The Instruction Cycle, Instruction Pipelining, The x86 Processor Family, The ARM Processor. **08 Hrs**

Unit IV: Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, The Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining. RISC versus CISC. **08 Hrs**

Unit V : Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, Microprogrammed control, Basic Concepts, Microinstruction Sequencing & Execution. **08Hrs**

Unit VI : Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization. **08 Hrs**

Text Book:

William Stallings: "Computer Organization and Architecture", (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: "Computer Architecture", Oxford University Press.
2. J.P. Hayes: "Computer Architecture and Organization" ,McGraw Hill.
3. D.A. Patterson, J.L. Hennessy: "Computer Architecture" Morgan Kauffmann, 2002.
4. Hwang and Briggs: "Computer Architecture and Parallel Processing" McGraw-Hill.

FREE ELECTIVE-II
6FEKE05 (i) JAVA PROGRAMMING

Unit I: Java features, Program Structures. Fundamentals of Java Programming, Primitive data types and operations, Selection statements, loops, Methods and Arrays in Java.

Unit II: Classes & Objects in Java, Creating Objects, Methods, Constructors, Class Variable and Methods, this keyword, Arrays of objects, String class, Character class, StringBuffer class, Command Line Arguments. File class, Text I/O.

Unit III: Inheritance: Inheritance vs. Aggregation, super keyword, final keyword, Method Overriding & overloading. Object class, ArrayList class. Protected data & methods, Final classes, methods & variables. Abstract classes and Interfaces.

Unit IV: CUI programming: GUI components, Java GUI API, frames, layout managers, Color class, Font class, Panels, Swing GUI components, Image icons. Graphics class, Polygon class.

Unit V: Event-Driven programming: Event & Event sources, Event delegation Model, Event listeners, registration and handling. Adapter classes, Inner Classes. Mouse events, Key events. Creating user interfaces: Buttons, Checkboxes, Radio buttons, Labels, Text Fields, Combo Boxes, Lists, Scroll Bars, Sliders.

Unit VI: Applets: Applet class and JApplet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint(), update() and repaint(), More about applet tag, getDocumentBase() and getCodeBase() methods.

Text Book:

Liang Y Daniel: Introduction to Java Programming, (Pearson-PHI)

Reference Books:

1. Herbert Schildt: Java Complete References (McGraw Hill)
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Khalid Mughal: A Programmer's Guide to Java Certification, 3rd Edition (Pearson)
4. Sachin Malhotra & Saurabh Choudhary: Programming in Java, (OUP).

FREE ELECTIVE-II
6FEKE05 (ii) EXPERT SYSTEMS

Unit I: Introduction: Definitions & importance. DP, MIS & DSS. Artificial Intelligence: overview. Evolution of expert Systems. Early expert systems: their characteristics, features& applications. Recent Expert systems: future Expert systems.

Unit II: Components of knowledge is ES. Knowledge representation methods. Representation via Rule-based systems. Knowledge acquisition & domain expert. Example, Knowledge acquisition via Rule Introduction. Software rule introduction.

Unit III: Inference engine: Role, Search strategies, Forward chaining algorithm. Backward chaining algorithm. Max modes. ES Modularity. Enhancements: Uncertainty concepts& approaches to uncertainty. Bridges in ES Explanation.

Unit IV: Validation: ES justification, rule-based validation. Performance verification. Case study. Hybrid ES: Defination. Importance. Examples of Hybrid ES, an overview of permutation search.

Unit V: ES departments: overview, development Languages'. ES shells. ES environments.ES hardware. Implementations: Overview milestone chart, software & hardware considerations monitoring, Maintenance & documentation.

Unit VI: Staffing & training: Overview, essential & supplemental tools. Justifications, organizational considerations. Oversight & evolution. ES & Heuristic programming. Future trends in expert systems. ES development flow diagram.

TextBook:

Igniazio James P." Introduction to Expert Systems", (McGraw Hill)

Reference Books:

1. Rolston "Expert System Design", (Mc Grew Hill)
2. Hayes Roth "Expert System Design" , (Addison-Wesley)
3. Patterson "Artificial Intelligence & Expert Systems", (PHI)

6KE06 PROFESSIONAL ETHICS

Unit I : Introduction: Computers in a Social Context. Moral and Legal Issues. Computer Ethical Issues. Philosophical Ethics: Descriptive and Normative Claims, Ethical Relativism, Utilitarianism, Deontological Theories, Rights, Virtue Ethics, Individual and Social Policy Ethics. Professional Ethics: Characteristics and system of Professions, Computing as Profession, Professional Relationships, Conflicting Responsibilities, Code of Ethics and Professional Conduct, Collective Responsibility. **08 Hrs**

Unit II : Ethics and The Internet: Three Morally Significant Characteristics, Hacking and Hacker Ethics, New Species of Old Crime, Netiquette, And Policy Approaches. Computers and Privacy issues, Legislative Background, Global Perspective, Proposals for Better Privacy Protection. Property Rights in Computer Software: Definitions, Current Legal Protection, Philosophical basis and analysis of Property, Proprietary Software, and Software Copying. **08 Hrs**

Unit III : Accountability, Computer and Information Technology: Different Senses of Responsibility, Buying and Selling Software, Y2K Problem, Diffusion of Accountability, Internet Issues, ISP Liability, and Virtual Action. Technology and Social change, Embedded Values, Enhanced and Impeded Values, Democratic Values in the Internet, Internet as Democratic Technology, Access and the Digital Divide, Free Expression, Overarching and Future Issues. **08Hrs**

Text Book:

Deborah G. Johnson: "Computer Ethics" Pearson Education (Third Edition).

Reference Books:

1. George Reynolds: "Ethics in Information Technology" Cengage Learning.
2. Hester and Ford: "Computers and Ethics in the Cyberage.
3. Duncan Langford: "Internet Ethics"
4. Richard A. Spinello: "Case Studies in Information Technology Ethics" PHI.

6KE07 Operating Systems Lab.: Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

6KE08 Database Systems Lab.: Minimum Eight experiments/ programming assignments must be completed based on the respective syllabus uniformly covering each of the units along with one mini project.

6KE09 Computer Lab-II (Hardware Lab): This lab is based on PC organization, troubleshooting & maintenance.

Student should perform practical on the following areas of PC:

1. PC models.
2. Inside the PC.
3. Preventive maintenance.
4. PC troubleshooting.
5. Semiconductor memories
6. Power supplies & power protection
7. Hard Disks: installing, configuring & maintenance
8. SCSI drives
9. Printers & their troubleshooting
10. Modems & serial interfaces, USB's and Devices.
11. Keyboard, Mice, Video adapters & displays
12. Sound boards, Video capture & CD ROMs.
13. Study of PC Ports & Interfacing Cards.

Books :

1. Mark Minasi : Complete PC upgrade & Maintenance Guide (BPB)
2. Scott Muller: Upgrading and Repairing PCs 12/e (Que)

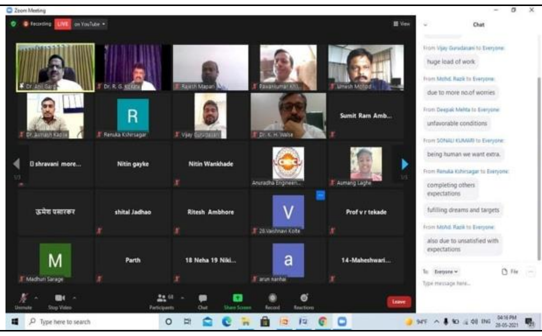
2.Courses organized by institute addressing issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability

1. “Atmadhyan Chitramalika “ by Ms. Anisa Mahabale dated .11.11.2022


व्याख्यान
अनुराधा अभियांत्रिकी महाविद्यालय, चिखली

2.	Holy literature presentation with auspicious hand of Hari Narayan Das & Kurma Kripa Das ISKCON, Juhu, Mumbai


3. Webinar on Stress Management Dr Anilkumar Garg dated 28/05/2021



4. Sarod Recital by Pt. Pradeep Kumar Barot by SPIC MACAY dated 18/10/2022
 

5. 4th National Conference on Green Technology for Sustainable Development dated 07/05/2023

चिखली : राष्ट्रीय परिसंवादाला उपस्थित मान्यवर.

अनुराधा अभियांत्रिकीमध्ये राष्ट्रीय परिसंवादाचे आयोजन

शाश्वत विकास विषयाचे उलगडले पैलू

▶सकाळ वृत्तसेवा

चिखली, ता. ८ : आज शाश्वत विकासावर जगभरात चर्चा होतांना दिसत आहे. कोणत्याही क्षेत्रातील असा विकास कि जो निसर्गावर, मानवावर दुष्परिणाम करणार नाही तो शाश्वत विकास होय असे प्रतिपादन कवियात्री बहीणाबाई चौधरी उत्तर महाराष्ट्र विद्यापीठाचे प्राध्यापक डॉ. राजकुमार सिरसाम यांनी व्यक्त केले. ते स्थानीक अनुराधा अभियांत्रिकी महाविद्यालय चिखली येथे आयोजीत ४ थ्या "राष्ट्रीय कॉन्फरन्स ऑन ग्रीन टेक्नॉलॉजी फॉर सस्टेनेबल डेव्हलपमेंट" या विषयावर आयोजित परिसंवादाचे प्रमुख पाहुणे म्हणून बोलत होते.

आज आपल्या वापरात असलेले अनेक इलेक्ट्रॉनिक्स उपकरण ज्या दिवषी निरूपयोगी होतील व क्वॉटंम कॉम्प्युटींग बेस उपकरण वापरात येतील त्यावेळेचे जग फार वेगळे असेल. एक आश्वासक असे विचार डॉ. मदन यु खरात यांनी कि-नोट स्पीकर म्हणून याप्रसंगी व्यक्त केले.

आपले अध्यक्षीय मनोगत व्यक्त करताना महाविद्यालयाचे प्राचार्य डॉ. अरुण नन्हई यांनी सांगीतले की, अमर्याद विकासाच्या अनेक दुष्परीणामांवर मात करून शाश्वत विकास करायचा असेल तर सर्वप्रथम मानवाने केवळ आपल्या स्वतःपुरता विचार न करता संपूर्ण विश्वाचा, त्याचा प्रत्येक घटकाचा विचार केला पाहीजे. कृत्रिम बुध्दीमत्ता याकरीता सर्वोत्तम व निःपक्ष उपाय असेल जो सर्व विश्वाला एकसमान मानेल.

याप्रसंगी परमहंस रामकृष्ण मौनीबाबा शिक्षण संस्थेचे कोशाध्यक्ष सिद्धेश्वर वानेरे, अनुराधा औषध निर्माण महाविद्यालयाचे प्राचार्यव्दय डॉ. के.आर.बियाणी, डॉ. आर.आर.पागोरे, भगवान बाबा महाविद्यालय सिंदखेडराजाचे प्राचार्य डॉ के.एच.वळसे, अनुराधा नर्सिंग महाविद्यालयाचे प्राचार्य मेनका, सोफिया, या परिसंवादाचे मुख्य समन्वयक डॉ.अविनाश कापसे आदी मान्यवर उपस्थित होते. कार्यक्रमाचे सूत्रसंचालन अविष्कार चव्हाण व पुर्वा पाटील यांनी केले.

6. Development of Energy Sources by Mr. Rohan Saoji

7. 1000 trees plantation (Kawad Yatra) organized by Dept. of Chemical Engg.dated 18/02/2023

8. Beti Bachao Beti Padhao Abhiyan organized ny NSS Unit of institute dated 10/01/2022 to 14/01/2022

9. Tree Plantation organized by NSS Unit of institute dated 02/07/2022

10. Swachata Abhiyan organized by NSS Unit of institute dated 02/10/2022

11. Tree Plantation organized by NSS Unit of institute dated 15/08/2022

No. AEC /Report/Azadika Amrit Mahotsaw/2022/1895 Date 19 / 08 /2022

To,
Hon. Secretary,
All India Council of Technical Education.
New Delhi.

Subject: Regarding submission of report on various programs conducted under **"Azadi Ka Amrit Mahotsav"**

Sir,

Pursuant to the above subject, we have organized various programs in Anuradha Engineering College from 5th August 2022 to 17th August 2022 under **"Azadi Ka Amrit Mahotsav"**

Its detailed report is enclosed herewith for your kind information.

Thanking you

Enclosed:
1. Report
2. Photographs
3. Video tape (in soft copy)

ANURADHA ENGINEERING COLLEGE F740-89-203(E)/RC/94 CHIKHLI - 443201

Principal
Dr. Arun N. Nanhai
PRINCIPAL
Anuradha Engineering College
CHIKHLI Dist. Buldana

Anuradha Engineering College

Chikhli Dist. Buldana (Maharashtra)

Report on

Harghar Tiranga Campaign

"Azadi ka Amrit Mahotsav"

आज़ादी का
अमृत महोत्सव

While celebrating the Amrit Mahotsav of Independence, various programs were successfully organized in the college from August 05 to August 15, 2022. Following is a detailed report of the programs organized with the aim of commemorating the freedom fighters who sacrificed their lives for the country as well as the great men who have played a significant role in the development of the country after independence.

- Between 05th August to 10th August, 2022 various competitions such as Oratorical Competition, Essay Competition, Painting Competition were organized under National Service Scheme in the college, in which the students recorded enthusiastic response.
- On 12th August, 2022, 500 students of the college organized a rally from the main road of the city in the costumes of freedom fighters and great men who contributed valuable to the development of the country at 8.30 am under the Seshar Ghar Tirangash campaign. The rally was started from Buldana District Central Bank Circle in the city through bus station, Shivaji Chowk, Jayastambh Chowk, Chinchparisar, Junegaon upto Nagar Parishad. The rally was concluded at Nagar Parishad, Chikhali.

- In the rally, the students of the college performed 10 *Chitraraths* and street plays of Mahatma Gandhi's Salt Satyagrahà, Chalejao Movement, Dandiyatra, Bhagat Singh, Rajguru, Sukhdev, Pandit Jawaharlal Nehru, Mrs. Indira Gandhi, Dr. Babasaheb Ambedkar, Smt. Sarojini Naidu, Maulana Abdul Kalam Azad, Netaji Subachandra Bose, Lokmanya Tilak, Lal Bahadur Shastri, as well as Bharat Mata were presented in live costumes. For this presentation, the principal of the college had announced an incentive prize for the presentation in best costume with the awareness of the true identity of Mahatma Gandhi to the young students. As a result, 5 different scenes based on Mahatma Gandhi participated in the rally. Incentives were also announced for other appearances. The students in the rally, holding various playcards, Tricolor Flag in their hands, chanting slogans and performing street plays directed the citizens to their homes. Called for hoisting the National Flag between August 13 and August 15, 2022.

- Preparation of the program was done from August 1. In the rally, the president of the organization Hon. MLA Mr. Rahulbhau Bondre, all office bearers of the institute, Principal Dr. Arun Nanhai, Head of all Departments as well as teaching and non-teaching staff participated enthusiastically.

- The rally concluded with the speeches of dignitaries.

- On 15 August 2022, the principal of the college, Dr. Arun N. The Flag hoisting ceremony was completed by Dr. Nanhai. All the faculty members, non-teaching staff, volunteers from N.S.S. team and other students were present at the Flag hoisting ceremony. After hoisting the flag, a tree plantation program was held in the college.

- On August 17, at 11 am, a program of collective National Anthem singing was held.

Principal
Dr. Arun N. Nanhai

Anuradha Engineering College Chikhali

"Azadi ka Amrit Mahotsav"


उचललेस तू मीठ मूठभर,
साम्राज्याचा खचला पाया।
अनुराधा अभियांत्रिकी महाविद्यालय, चिखली
साजरा करीत आहे
स्वातंत्र्या चा
अमृत महोत्सव


अनुराधा अभियांत्रिकी महाविद्यालय, चिखली
साजरा करीत आहे
स्वातंत्र्याचा अमृत महोत्सव
स्वातंत्र्या चा
अमृत महोत्सव
REDMI NOTE 9
AI QUAD CAMERA


अनुराधा अभियांत्रिकी महाविद्यालय, चिखली
“मध्यरात्रीच्या झोपेच्या वेळी, जेव्हा
जग झोपेल तेव्हा भारत जिवन आणि
जय जवान
जय किसान
भारताचे पहिले पंतप्रधान
“जय जवान
जय किसान”


स्वातंत्र्याचा अमृत महोत्सव


REDMI NOTE 9
AI QUAD CAMERA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अनुराधा अभियांत्रिकी महाविद्यालय, चिखली
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स्वातंत्र्या चा अमृत महोत्सव
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अनुराधा अभियांत्रिकी महाविद्यालय
चिखली, जि. बुलडाणा
आजादी का
अमृत महोत्सव
निमीत्त
७५
वृक्ष लागवड
दि. १५ ऑगस्ट २०२२
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REDMI NOTE 9
AI QUAD CAMERA

अनुराधा अभियांत्रिकी महाविद्यालय
चिखली जि.बुलडाणा
राष्ट्रीय सेवा योजना
आजादी का
अमृत महोत्सव
अंतर्गत
दि.१५ ऑगस्ट २०२२ रोजी आयोजित करीत
७५ वृक्ष
लागवड मोहिम

Anuradha Engineering College, Chikhli

Report On

Celebrating International Women's day

Title: Women Empowerment

March 8

Venue: Anuradha Engineering College, Chikhli

Time: 12.00 am to 4.00 pm

Participants: Girls Engineering Students

The International women's day was celebrated at Anuradha Engineering College, Chikhli on 8th March. The purpose of celebrating Women's day is to raise awareness about the status and dignity of women among the students.

Activities Performed

1. **Women awareness Program:**This Program was coordinated by Prof. S. T. Sawale. Many Girls participated in this Program.
2. **"Vrukshasavardhan" (Tree Culture) Program:** This Program was coordinated by Prof. S. A. Patil. In this program students watered plants& performed activities related to maintainence of trees.
3. **Rangoli competition:** This competition was coordinated by Prof. DR. U. W. Karhe. Theme for the competition was **"Women's day".** 05 Student groups were participates in the competition.
4. **Poster competition:** This competition was coordinated by Prof. DR. U. W. Karhe.Theme for the competition was **"Economic empowerment"**. 01 Student groups were participates in the competition.
5. **Essay competition:** This competition was coordinated by Prof. DR. U. W. Karhe.Theme for the competition was **"Role of education".** 09 Students were participates in the competition.

6. **“Ghoshvakya” (Slogan) competition:** This competition was coordinated by Prof. DR. U. W. Karhe. Theme for the competition was “**Gender equality**”. 02 Students were participates in the competition.
7. **Drawing competition:** This competition was coordinated by Prof. DR. U. W. Karhe.Theme for the competition was **“Woman power”.** 04 Students were participates in the competition.
8. **“Vakrutva” (Oratory) competition:** This competition was coordinated by Prof. DR. U. W. Karhe. Theme for the competition was “**Peace and security**”. 03 Students were participates in the competition.

Rangoli Competition pics

“Vrukshasavardhan”Pics on “International Women’s day”

“Vakrutva” (Oratory) competition

Poster competition

"Women Safety Awareness Programme"

On the occasion of Women's day and as per notice from AICTE, on 8th March Women's safety awaressprogramme was organize. The girl students of all branches from second to final year attended the programme in Room number B-307. Prof. S. T. Sawale(IT Dept.) and Prof. M. K. Sadar (CSE Dept.) gives the useful information about safety through power point presentation to students. The presentation contents were History of women's day, Indian Acts, safety apps, helpline numbers, videos etc. Students had shown their enthusiasm for the programme. The anchoring was done by the students of final year IT Ms. PriyankaPawar and Ms. VaishnaviAmbaskar.

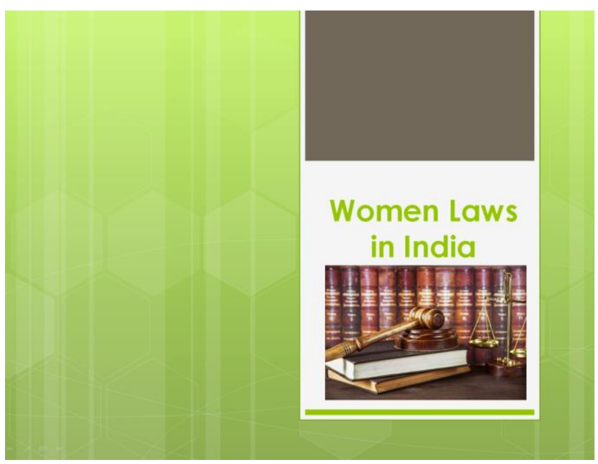
The photographs and Presentation content are attached with this report.

Photographs:

PPTs:

HISTORY

- In 1909, the first Women's Day was observed across the United States.
- In 1910, an International conference of working women was held in Copenhagen. That's where the idea was proposed by Clara Zetkin, a leader of the Women's Office for the Social Democratic Party in Germany.
- In 1911, International Women's Day was honoured for the first time in Austria, Denmark, Germany and Switzerland on 19 March.
- Between 1913 and 1914, women in Russia observed their first Women's Day on February 23.
- Later, it was decided that March 8 can the globally accepted day to celebrate International Women's Day .



Women laws in India

- Section 304(B) IPC
- Domestic Violence Against Women Act 2005
- Penal Laws
- Family Laws
- Labour Laws
- Human Rights and Women Legal Aid
- The Immoral Traffic (Prevention) Act 1956
- Medical Termination of Pregnancy Act 1971
- Hindu Succession Act
- Special Marriage Act 1955
- Child Marriage Act 1929
- Hindu's Widow Remarriage Act 1865
- Custody of child
- Adoption of child
- Maintainance
- Guardianship

Women Safety apps

7 best women safety apps

- Women safety has become the utmost priority of the Indian government considering the increasing cases of crime against women.
- There are various safety apps present on the play store designed for the protection and security of women.
- Therefore on this International Women's day we combined a list of best 7 safety apps for women, which will ensure that they are not alone anywhere they go.
- The basics of most apps are similar — a user-decided list of emergency contacts to alert, and transmission of GPS-determined location — but the newer ones are easier to use, almost intuitive.
- Take a look and download the one you like the most:

1.Safetipin

- Safetipin is one of the good options when it comes to safety apps for women. The app is designed keeping in mind the concept of personal safety.
- It incorporates all the essential features such as GPS tracking, emergency contact numbers, directions to safe locations etc. The app also pins the safe areas along with their safety scores to go at the time of any problem.

2. The Raksha

The Raksha app is designed to ensure that women stay safe always. The app comes equipped with a button, which will send alerts to your loved ones with your location in a situation of distress.

3. Himaat

- The Himaat app is a free safety app recommend for women by the Delhi Police. In order to use the app, the user has to register at the Delhi Police website.

4. Women Safety app

- The next on our list is the Women Safety app that will inform and update your dear ones if you are stuck in an unsafe place. It will send all the details related to your location with just a tap of a button. The app will send an SMS to a preconfigured number along with your location and a link of Google Maps.

5. Smart24x7

- The Smart24x7 app is supported by the various states' police just to ensure the safety of women and senior citizens.
- The app sends panic alerts to emergency contacts in a problematic situation. It also records voices and also takes photographs during the panic situation and transfers these to the police as well.

6. Shake2Safety

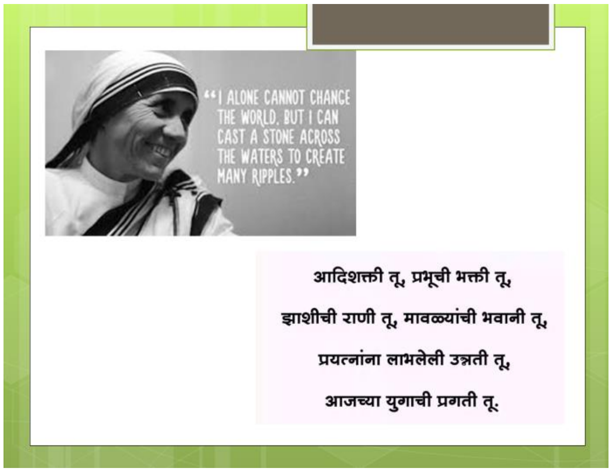
- The Shake2Safety app is the easiest to use. The user just needs to shake their smartphone or just press the power button four times to send an SOS text or call to the registered numbers.
- It works with the locked screen on and even without an internet connection.

7. bSafe

- The bSafe app e[redacted]afety and security of women. It [redacted]acts follow you through a live [redacted]also set a timed alarm which g[redacted]ven't 'checked in'.

Women Helpline Numbers

WOMEN HELPLINE NUMBERS	
Women Helpline (All India) - Women In Distress (suffering/pain/sorrow)	**1091**
Women Helpline Domestic Abuse	**181**
Police	**100**
MAHARASHTRA	
Police	9833331111
Mumbai Police Women Helpline No.	022-22633333, 22620111
Maharashtra Women Commision http://mscw.org.in/ (Gruha Nirman Bhawan Mhada Bldg., Kalanagar, Bandra)	07477722424 022-26592707
Maharashtra Women Helpline	022-26111103, 1298 , 103
MAJLIS - MAHARASHTRA	022-26661252 / 26662394
Navi Mumbai Police Station	022-27580255


"I ALONE CANNOT CHANGE THE WORLD, BUT I CAN CAST A STONE ACROSS THE WATERS TO CREATE MANY RIPPLES."
आदिशक्ती तू, प्रभूची भक्ती तू,
झाशीची राणी तू, मावळ्यांची भवानी तू,
प्रयत्नांना लाभलेली उन्नती तू,
आजच्या युगाची प्रगती तू.


Women/Girls Safety Video


https://www.youtube.com/watch?v=xs32VPF1VYs


HAPPY Women's DAY.


Thank You…

15. Nirupan on "Ramayana" delivered by Dr. Arun N. Nanhai attended by all staff and students dated 03/03/2023.

16. Daily National Anthem before the commencement of Classes

Arun Narayan Nanhai

Digitally signed by Arun Narayan Nanhai
DN: c=IN, o=Personal, title=9481, pseudonym=6FtRn86oloSk9GfxzyGyj4qDFXp5z0BZ, 2.5.4.20=aebd8eb98f199d4a040d7db461ef0a25271c0f59aa1ae78ce570fb2d6f81c07e, postalCode=443201, st=Maharashtra, serialNumber=4d9109a773dee89ab04bcb9bd1f389f834b3072351afd1237358ec53fda32b09, cn=Arun Narayan Nanhai
Date: 2024.01.21 16:55:28 +05'30'

Principal, Anuradha Engineering College, Chikhli