EE Electrical Engineering

Section 1: Engineering Mathematics

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigenvalues, Eigenvectors.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line integral, Surface integral, Volume integral, Stokes's theorem, Gauss's theorem, Divergence theorem, Green's theorem.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's equation, Euler's equation, Initial and boundary value problems, Partial Differential Equations, Method of separation of variables.

Complex variables: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, Laurent series, Residue theorem, Solution integrals.

Probability and Statistics: Sampling theorems, Conditional probability, Mean, Median, Mode, Standard Deviation, Random variables, Discrete and Continuous distributions, Poisson distribution, Normal distribution, Binomial distribution, Correlation analysis, Regression analysis.

Section 2: Electric circuits

Network elements: ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem; Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits.

Section 3: Electromagnetic Fields

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law,Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

Section 4: Signals and Systems

Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Applications of Fourier Transform for continuous and discrete time signals, Laplace Transform and Z transform. R.M.S. value, average value calculation for any general periodic waveform

Section 5: Electrical Machines

Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Types of losses and efficiency calculations of electric machines

Section 6: Power Systems

Basic concepts of electrical power generation, ac and dc transmission concepts, Models and performance of transmission lines and cables, Economic Load Dispatch (with and without considering transmission losses), Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss- Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Section 7: Control Systems

Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems

Section 8: Electrical and Electronic Measurements

Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multimeters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Section 9: Analog and Digital Electronics

Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications; single stage active filters, Active Filters: Sallen Key, Butterwoth, VCOs and timers, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.

Section 10: Power Electronics

Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Single and three-phase configuration of uncontrolled rectifiers; Voltage and Current commutated Thyristor based converters; Bidirectional ac to dc voltage source converters; Magnitude and Phase of line current harmonics for uncontrolled and thyristor based converters; Power factor and Distortion Factor of ac to dc converters; Single-phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation.

CE	Civil Engineering

Section 1: Engineering Mathematics

Linear Algebra: Matrix algebra; Systems of linear equations; Eigen values and Eigen vectors.

Calculus: Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima; Taylor series; Evaluation of definite and indefinite integrals, application of definite integral to obtain area and volume; Partial derivatives; Total derivative; Gradient, Divergence and Curl, Vector identities; Directional derivatives; Line, Surface and Volume integrals.

Ordinary Differential Equation (ODE): First order (linear and non-linear) equations; higher order linear equations with constant coefficients; Euler-Cauchy equations; initial and boundary value problems.

Partial Differential Equation (PDE): Fourier series; separation of variables; solutions of one-dimensional diffusion equation; first and second order one-dimensional wave equation and two-dimensional Laplace equation.

Probability and Statistics: Sampling theorems; Conditional probability; Descriptive statistics – Mean, median, mode and standard deviation; Random Variables – Discrete and Continuous, Poisson and Normal Distribution; Linear regression.

Numerical Methods: Error analysis. Numerical solutions of linear and non-linear algebraic equations; Newton's and Lagrange polynomials; numerical differentiation; Integration by trapezoidal and Simpson's rule; Single and multi-step methods for first order differential equations.

Section 2: Structural Engineering

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Construction Materials and Management: Construction Materials: Structural Steel – Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams.

Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

Section 3: Geotechnical Engineering

Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One-dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.

Foundation Engineering: Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

Section 4: Water Resources Engineering

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures.

Section 5: Environmental Engineering

Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment.

Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different

applications.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Section 6: Transportation Engineering

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

Geometric design of railway Track – Speed and Cant.

Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.

Section 7: Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.

Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.

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CS Computer Science and Information Technology

Section 1: Engineering Mathematics

Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Monoids, Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition.

Calculus: Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.

Probability and Statistics: Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

Computer Science and Information Technology

Section 2: Digital Logic

Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Section 3: Computer Organization and Architecture

Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining, pipeline hazards. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Section 4: Programming and Data Structures

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Section 5: Algorithms

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths

Section 6: Theory of Computation

Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

Section 7: Compiler Design

Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation. Local optimisation, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination.

Section 8: Operating System

System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems.

Section 9: Databases

ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Section 10: Computer Networks

Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

ME Mechanical Engineering

Section 1: Engineering Mathematics

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Complex variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.

Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Section 2: Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and

welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Section 3: Fluid Mechanics and Thermal Sciences

Fluid Mechanics: Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Applications: *Power Engineering*: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. *I.C. Engines*: Air-standard Otto, Diesel and dual cycles. *Refrigeration and air-conditioning*: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. *Turbomachinery*: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

Section 4: Materials, Manufacturing and Industrial Engineering

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools;

additive manufacturing.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

Inventory Control: Deterministic models; safety stock inventory control systems.

Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

EC Electronics and Communications

Section 1: Engineering Mathematics

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigenvalues and eigenvectors, rank, solution of linear equations- existence and uniqueness.

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.

Vector Analysis: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stokes' theorems.

Complex Analysis: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, sequences, series, convergence tests, Taylor and Laurent series, residue theorem.

Probability and Statistics: Mean, median, mode, standard deviation, combinatorial probability, probability distributions, binomial distribution, Poisson distribution, exponential distribution, normal distribution, joint and conditional probability.

Section 2: Networks, Signals and Systems

Circuit analysis: Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform.

Linear 2-port network parameters, wye-delta transformation.

Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications.

Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay.

Section 3: Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.

Carrier transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations.

P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

Section 4: Analog Circuits

Diode circuits: clipping, clamping and rectifiers.

BJT and MOSFET amplifiers: biasing, ac coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers.

Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

Section 5: Digital Circuits

Number representations: binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay.

Data converters: sample and hold circuits, ADCs and DACs.

Semiconductor memories: ROM, SRAM, DRAM.

Computer organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

Section 6: Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

Section 7: Communications

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers.

Information theory: entropy, mutual information and channel capacity theorem.

Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER.

Fundamentals of error correction, Hamming codes, CRC.

Section 8: Electromagnetics

Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart.

Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

Printing Engineering

First Year First Semester

Hum/T/A HUMANITIES-A

English - 2 Pds/week - 50 Marks
Sociology - 2 Pds/week - 50 Marks

HUMANITIES

1.Basic writing skills
2.Report, Covering Letter & Curriculum-Vitae writing
3.Reading and Comprehension
4.Selected Short Stories

Text Book: ENGLISH FOR ALL

SOCIOLOGY

1.Sociology: Nature and scope of Sociology - Sociology and other Social Sciences - Sociological Perspectives and explanation of Social issues
2. Society and Technology: Impact of Technology on the Society - A case study
3. Social Stratification: Systems of Social Stratification - determinants of Social Stratification - Functionalist, Conflict and Elitist perspectives on Social Stratification
4.Work: Meaning and experience of work: Postindustrial society- Post-Fordism and the Flexible Firm
5.Development - Conceptions of and approaches to development - The Roles of State and the Market in the Development
6. Globalization: The concept of globalization - globalization and the nation state - Development and globalization in post colonial times.
7. Industrial Policy and Technological change in India - The nature and Role of the State in India
8. Technology Transfer: The Concept and Types of Technology Transfer-Dynamics of Technology Transfer
9. Technology Assessment: The Concept - Steps involved in Technology Assessment
10. Environment: Sociological Perspectives on Environment - Environmental Tradition and values in ancient India
11.The Development of Management: Scientific Management - Organic Organization - Net Work organization - Post modern Organization - Debureaucratization - Transformation of Management
12. Technological Problems and the Modern Society: Selected Case Studies - Electric Power Crisis, Industrial and/or Environmental Disaster, or Nuclear Accident.

PRN/Math/T/112 MATHEMATICS-IR

Functions of a single variable, limit, continuity and differentiability, Successive differentiation, Rolle's theorem (statement only), Mean value theorem, Taylor's and Maclaurin's expansions, Indeterminate forms. Maxima and minima of functions of a

single variable. Fundamental theorem and mean value theorems of integral calculus, Evaluation of definite and improper integrals, Beta and Gamma functions. Functions of two variables, limit, continuity, partial derivatives. Euler's theorem for homogeneous functions, total derivatives. Maxima and minima, Lagrange's method of multipliers. Integration by resolution into partial fractions. Some elementary properties of definite integrals (to be defined as the limit of a sum) Lengths and areas of plane curve. Volumes and surface areas of solids of revolution. Use of multiple integrals in calculation of areas and volumes. Numerical integration by Trapezoidal and Simpson's rules

PRN/PE/T/113 ENGINEERING MECHANICS

Elements of vector algebra, Basic dimensions and units, Newton's Laws, Equilibrium equations, Frictional forces, Centroid, Area moment of inertia, Differentiation and integration of vectors with respect to time, Rectilinear and curvilinear motion of particle, D'Alembert's Principle, Method of momentum, Work, Power & Energy.

PRN/CSE/T/114 PROGRAMMING LANGUAGE

Programming : Elementary concepts and terminology of a computer system and system software, Fortran77 and C programming.
Fortran : Program organization, arithmetic statements, transfer of control, Do loops, subscripted variables, functions and subroutines.
C language : Basic data types and declarations, flow of control- iterative statement, conditional statement, unconditional branching, arrays, functions and procedures.
Linear lists - arrays, linked lists, stacks and queues. Trees - binary trees, binary search trees, multiway trees. Graphs. Strings. Searching and sorting techniques. File structures - sequential, relative, indexed-sequential, direct.

PRN/T/115 PRINTING TECHNIQUES

An introduction to different printing processes such as letter press, lithography/offset, gravure, intaglio, flexography, and screen printing. A short history of the printing process.
Letterpress: an introduction to typographic design, type details, measurements, point size, lead, page make-up, proof reading and corrections, general awareness of the factors which decide the choice of type face, etc. Methods for graphic block reproduction, line and halftone production. Introduction to letter press printing machines, introduction to different type setting methods.
Lithography: lithographic planning and applications, introduction to sheet and web fed machines, pre-make-ready concepts, ink and water balance in lithography.
Gravure: introduction to gravure printing process.
Flexography: introduction to flexography printing process.
Nonimpact Printing: Introduction to digital printing, thermal printing, laser printing, ink jet printing etc.
Screen Process Printing : Screen printing principle, Screen mesh, Screen printing frames, Screen pretreatment, Degreasing, Different method of stencil preparation, Multicolor

reproduction, Screen printing problems and solutions, Screen ink and their properties, Machinery configuration

References :

* Stephens John, Screen Process Printing, Blueprint
* Samuel Hoff, Screen Printing, A Contemporary Approach, Delmar Publishers
* Appleton William, Screen Printing, A literature review, Pira International
* Adams J. Michael, Faux D. David, Rieber J. Lloyd, Printing Technology, Delmar Publishers
* Eldred Nelson R., Chemistry for the Graphic Arts, GATF
* Lithographers Manual, GATF.
* Photo-Engraving in Relief; Smith, Turner and Hallam; Pitman Publishing Corporation, London.
* Printing Technology; Adams, Faux and Rieber.

Ph/T/1C PHYSICS-IC

1. Potential and intensity and their relation - gravitational and electrostatic examples, States of equilibrium, Work and Energy, Conservation of energy,
2. Surface tension, excess pressure inside a soap bubble, capillary rise- Jurin's law. Bernoulli's theorem and its applications.
3. Lens system (combination of thin lenses), eyepieces, microscope,
4. Nature of light waves, Interference of light waves, Young's experiment, Spatial and temporal coherence, Fresnel bi-prism, Interference in thin film, Newton's rings, Measurement of film thickness and wavelength, Diffraction of light waves, Huygen's construction, Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction due to single slit and plane diffraction grating, Polarisation of light waves, Polarisation by reflection, Brewster's law, Double refraction- ordinary extraordinary rays, Polaroid.
5. Macroscopic and microscopic description, Thermal equilibrium, Zeroth law of thermodynamics, Concept of international practical temperture scale, Heat and Work, First law of thermodymamics and some applications, Reversible and irreversible processes, Carnot cycle, Second law of thermodymamics, Concept of entropy, Thermodynamic relations.
6. Electric potential and intensity, Flux of electric field, Gauss's law and its application to problems with spherical and cylindrical symmetry, Capacitance- parallel plate and spherical condensers. Biot-Savart law and Ampere's law in magnetostatics, Calculation of magnetic field in simple situations like (i) straight wire (ii) circular wire (at a point on the symmetry axis) and (iii) Solenoid, Time-varying fields, Faraday's law of electromagnetic induction, Self and mutual inductance.
7. Energy levels of the hydrogen atom and the Bohr atom model, X-ray spectra, X-ray diffraction, Bragg's law, Compton effect. De-Broglie waves, Particle diffraction, Uncertainty principle and its application.

PRN/CSE/S/111 PROGRAMMING LANGUAGE LABORATORY

Fortran : Program organization, arithmetic statements, transfer of control, Do loops, subscripted variables, functions and subroutines.
C language : Basic data types and declarations, flow of control- iterative statement, conditional statement, unconditional branching, arrays, functions and procedures.
Linear lists - arrays, linked lists, stacks and queues. Trees - binary trees, binary search trees, multiway trees. Graphs. Strings. Searching and sorting techniques. File structures - sequential, relative, indexed-sequential, direct.

PRN/S/112 PRINTING ENGINEERING DRAWING

Lettering, scale, orthogonal and isometric projections. sections, geometrical drawings, elementary machine drawing.
Practical : Machine drawing-assembly and split up, drawing of machine elements.

PRN/S/113 PRINTING TECHNIQUES LABORATORY

1. Some study on the nomenclature of the type face for letter press processes and arrangement of type on the type case.
2. Composition and page make-up using foundry type.
3. Preparation of line and halftone block for letter press process.
4. Study of the letter press printing unit.
5. Composition and page make-up using digital type setting technique.
6. Study of the offset printing unit.
7. Study of the gravure printing unit.
8. Study of the flexography printing unit.
9. Measurements of the paper properties such as brightness, gloss, tearing strength, folding endurance, etc.

PRN/PE/S/114 WORKSHOP PRACTICE

Fitter Shop, Carpentry, Molding and Welding.

First Year Second Semester

PRN/Math/T/121 MATHEMATICS-IIR

Linear Algebra : Determinates, Solution of liner equations using determinants. Matrices: Definitions, operations and solution of equations.algebra of matrices, rank, inverse, system of linear equations, symmetric, skew-symmetric and orthogonal matrices. Hermitian, skew-hermitian and unitary matrices. eigenvalues and eigenvectors, diagonalisation of matrices, Cayley-Hamiltonian, quadratic forms.
Complex number. Demoiver's theorem. Exponential values of Sine and Cosine.
Determinants (upto fourth order): definitions and properties.
Complex variable: Analytic functions, Cauchy's integral theorem and integral formula without proof. Taylor's and Laurent' series, Residue theorem (without proof) with application to the evaluation of real integrals.

Probability and Statistics: Set theory and elements of Boolean algebra, Definitions of probability and simple theorems, conditional probability, mean, mode and standard deviation, random variables, discrete and continuous distributions, Poisson, normal and Binomial distribution, correlation and regression
Application of calculus to plane curves . tangent and normal, curvature, convexity and concavity concepts.
Cartesian coordinates in three dimensions. Direction cosines, planes and straight lines. Standard equation of sphere, cone and cylinder.

PRN/PE/T/122 STRENGTH OF MATERIALS

Stress, Strain and Elasticity, Thermal Stress, Resilience and shock energy, Thin cylindrical and spherical shells under internal pressure, Shearing stress and strain, Elastic constants, Torsion of a circular shaft, Angle of twist, Torque and horse-power. Closed coil helical spring. Shearing force and bending moment in beams, Maximum moment and point of contraflexture, Simple theory of bending, Momentum of resistance, Section modulus, Deflection of beams - Analysis of stress principles, stress and strain. Mohr's circle for stress. Principle stress due to combined loading, Lami's equation.

PRN/PE/T/123 ELECTRICAL TECHNOLOGY

Electrical units, Dimensions, Electro-magnetism, Magnetic circuits, DC and AC circuits, DC Generators and Motors, Motor starters, Electrical measuring instruments, AC Machines - Induction Motors &Alternators, Balanced three-phase circuits, Construction and operation of Transformers, Voltage variation devices, Different types of lamps used in printing, Hg-Vapour, Metal halide and Halogen lamps.

PRN/IEE/T/124 ELECTRONICS

Passive circuits elements, resonance, network theorem, terminal characteristics of P-N junctions, Use of diode as clamper, clipper, rectifier filters. Terminal characteristics of bi-polar transistor. Transistor as a control device, concepts of current gain, cutoff, active and saturated transistors, load line and Q-point. Selection in connection with CE amplifier circuits. Self-biased CE configuration, CC configuration - DC condition, principle of operation and qualitative discussion on gain. Input and output impedance, signal handling capacity, frequency response, cascading of stages - RC coupling only. Terminal characteristics of zener diode and applications. Series mode and shunt mode voltage regulators. Feed back amplifiers - principles of operations, gain frequency response, input impedance, output impedance, distortion and noise reduction.
Difference amplifiers, common mode gain, difference mode gain, CMRR. Input & output impedance, operational amplifiers - a basic building block. Terminal characteristics.
Use of practical OP Amp as circuit element. Application of OP Amp as an inverter, voltage follower, adder, integrator, differentiator, log amplifier, instrumentation amplifier.
Waveform generator- Astable, Monostable and Bistable multivibrators. Sweep

generation, constant current charging. Use of OP amps in waveform generation, Timer (555) and its applications.

PRN/CSE/T/125 COMPUTATIONAL STUDIES

Numerical Methods: Truncation errors, round off errors and their propagation; Interpolation; Lagrange, Newton's forward, backward and divided difference formulas, least square curve fitting, solution of non-linear equations of one variables using bisection, false position, secant and Newton Raphson methods; Rate of convergence of these methods, general iterative methods. Simple and multiple roots of polynomials. Solutions of system of linear algebraic equations using Gauss elimination methods, Jacobi and Gauss-Seidel iterative methods and their rate of convergence; ill conditioned and well conditioned system. eigen values and eigen vectors using power methods. Numerical integration using trapezoidal, Simpson's rule and other quadrature formulas. Numerical Differentiation. Solution of boundary value problems. Solution of initial value problems of ordinary differential equations using Euler's method, predictor corrector and Runge Kutta method.

PRN/T/126 PRINTING MATERIAL SCIENCE-I

Interfacial surface tension, spreading of liquid on a surface, capillary action. Viscosity, Poiseuille's equation.
Radiation - Refraction, reflection, absorption and transmission of electromagnetic radiation in solids. Reflectivity, Transmitivity, Absorptivity. Concept of Black & White bodies. Various Lamps and light sources and their working principles.
Simple microscope,Qualitative discussions on Laser and its working principles.
Holography - Elementary examples.
Heat transfer, Conduction, Convection, Heat capacity, thermal conductivity, thermal expansion of materials.
Concept of energy band diagram for materials; conductors, semiconductors and insulators in terms of energy bands. Electrical conductivity, effect of temperature on conductivity in materials, intrinsic and extrinsic semiconductors, dielectric properties of materials.
Origin of magnetism in metallic and ceramic materials, paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism in materials and magnetic hysteresis.
Advanced materials: Smart materials exhibiting ferroelectric, piezoelectric, optoelectronic, semiconducting behaviour; lasers and optical fibers; photoconductivity and superconductivity in materials.

PRN/CSE/S/121 NUMERICAL ANALYSIS AND C PROGRAMMING LABORATORY

To supplement the theoretical courses on "Computational Studies" and "Programming Language".

PRN/S/122 SCREEN PROCESS PRINTING LABORATORY

1. Study of different tools, materials and equipments used in screen printing
2. Preparation of screen stencil in direct photographic stencil process and reproduction through it
3. Preparation of screen stencil in indirect photographic stencil process and reproduction through it
4. Preparation of screen stencil in direct and indirect photographic stencil process and reproduction through it
5. Preparation of screen stencil in capillary direct film process and reproduction through it
6. Printing of multicolour job
7. Printing on different types of substrate
8. Printed Circuit Board (PCB) making using Screen Process Printing
9. Study of different running on problems and trouble shooting

PRN/PE/S/123 ELECTRICAL TECHNOLOGY LABORATORY

To supplement the theoretical course on "Electrical Technology".

PRN/PE/S/124 MACHINE SHOP

Machine Shop - Working in Lathe, Shaping, Drilling and Milling machines, Basic concepts of machine tools and cutting tools.

Second Year First Semester

PRN/Math/T/211 MATHEMATICS-IIIR

Ordinary Differential Equations: First order exact and linear equation, Second and higher order linear differential equations with constant coefficients, Euler-Cauchy equations, method of variation of parameters, initial and boundary value problems, Laplace transforms. Solution of linear differential equation with constant coefficients by Laplace transform, solution of differential equations in series, Bessel's and Legendre's differential equations.
Legendre polynomials and Bessel's functions of the first kind.
Partial Differential Equations: Variables separable method, solutions of one dimensional heat, wave and two dimensional Laplace equations.

PRN/T/212 PAPER TECHNOLOGY

Raw materials for paper manufacturing - structure of cellulose, hemicellulose, and lignin and extractives. Pulping mechanical and chemical pulping, different types of paper produces from different types of pulp. Bleaching, wastepaper utilisation and de-linking, stock preparation. Internal sizing, effect of fillers to improve printability of paper, Colouring of paper. Fourdrinier paper machine, cylinder machine, Pressing, Drying. Calenders, Super calenders, Embossers, Surface treatment of paper and board-lamination, corrugating, paper reinforcement by polymer addition, different types of coating. Paper

cutting. Standard sizes of papers. Fibre analysis. Paper defects - dirt in papers, speck analysis.
Properties of paper - Structural properties, Physical properties, Strength properties, optical properties, resistance properties, chemical properties. On-line measurement of paper properties.

Reference: James P. Casey, Pulp and Paper (volume 1-4)

PRN/T/213 MECHANISM

Linkages, four bar linkages. Velocity analysis; instantaneous axis, relative velocity methods, Crank, rocker, draglink, non-parallel equal crank linkage; automobile steering mechanism; Slider crank, swinging block; oscillating arm quick return mechanism; whitworth quick return mechanism, isosceles linkage; toggle: pantograph: universal joint; Geneval drive, Paw! & Ratchet.
Transmission of Motion by direct contacts; pitch point angle of action, pressure angle, conjugate curves. Cam and follower; plate cams; cylindrical cams; displacement; velocity and acceleration diagrams. Bodies in rolling contact; Gears, spur gears, bevel gears, rack and pinions, worm gears; reverted gear trains; epicyclic gear trains. Belt drives, stepped pulley; chain drive; continuous feed systems: web feed systems; Differential screws; intermittent motion.
Different mechanisms related to offset printing machines.

PRN/T/214 GRAPHIC REPRODUCTION

Basic principles of reproduction camera. Overview of reproduction cameras, Contact printer, Enlarger, Layout of a darkroom, Camera lens, Depth of field, Hyper focal distance, Aperture & Iris diaphragm, Panchromatic, Orthochromatic, Blue sensitive films, Process films, exposure, developer & their ingredients, development, film speed & sensitivity, Silver halide chemistry, Basic sensitometry, Gamma, Characteristic curve, Densitometry, Colour filters, Colour separation, Halftone, Screen angles, Black printer, Colour correction. Digital photography and transmission scanner.

References :
* Burden, J. W., Graphic Reproduction Photography, Focal Press, London.
* Adams J. Michael, Faux D. David, Rieber J. Lloyd, Printing Technology, Delmar Publishers
* Cogoli John E., Graphic Arts Photography : Black and white, GATF
* Wentzel Fred, Graphic Arts Photography : Color, GATF
* Eldred Nelson R., Chemistry for the Graphic Arts, GATF

PRN/T/215 PRINTING ELECTRONICS

Pulse, Digital waveform characterisation, duration and period, Rise and fall time; overshoot and undershoot, linearity of sweep and its measure, etc. Basis logic gates: AND, OR, NOT, NAND, NOR, EXOR etc. Logical symbols and truthtables. Boolean

algebra, and DeMorgans theorem. Concept of universal logic. Characterisation of TTL and CMOs gates - speed of operation, power dissipation, Fan out, current and voltage parameters, power supply requirements etc. Number system and code. Combination logic, standard representation for logical function. Minimization technique (Karnaugh Map), design example. Sequential circuits--Flip-Flop families, Registers and counters. Memory design, Ram, Rom, Prom, Epron and E-square prom devices. Analogue to digital and Digital to analogue convertors. Successive approximation type. Dual slope type and comparator type, A-O convertor. Introduction to computer system design, CPU memory, I/O and peripheral Interface (Block level) and system integration philosophy.

PRN/T/216 DIGITAL TYPESETTING

Evolution of photocomposition: Evolution of phototype setting systems from hot-metal composition to digital composition environment. Desktop publishing.
Text and image input devices: Types of input devices; Keyboards: layout coding and structures. Keyboards for multilingual word processing. Mouse.
Storage media: Types of storage media. Magnetic memories, Semiconductor memories, Optical memories. Comparison and evaluation of various storage media.
Output devices: Types. Display devices. Printers, plotters and typesetters.
Software elements: Text editors. Word processors. Page layout packages. Graphics packages. OCR. Text file formats and file exchange.
Page composition: Editing and correction. Text alignment. Tables and columns. Indexing. Scientific composition. Text image integration. Pagination.
Digital typography: Generating methods of digital type faces. Font manipulation.
Page description languages: Way of working. Postscript and display postscript and other page description languages.

References:
* Adobe Systems Inc, PostScript Language Program Design, Addison-Wesley
* Adobe Systems Inc, PostScript Language Reference Manual (ed2), Addison-Wesley
* Barnett, Michael P., Computer Typesetting: Experiments and Prospects, MIT Press. Cambridge, Massachusetts.
* Bate, J. St. J. & Wilson-Davies K., Desktop Publishing, BSP Professional Books
* Bluhm A., Photo Composing, Pergamon, London.
* Card, Michael. Word Processor to Printed Page: A Guide to Interfacing Word Processors and Phototypesetters, Blue Print, London
* Edward Berg, N., The New Era of Electronic composition, GATF
* Encyclopedia of Contemporary Typesetting, GATF.
* French, C.S., Computer Studies, Galgotia Book Source Publishers, New Delhi.
* Goossens, M. & Mittlebach, F. & Samarin, A., The Latex Companion, Addison Wesley.
* Goossens, M. & Rahtz, S. & Mittlebach, F., The Latex Graphics Companion (Illustrating documents with Tex and Postscript), Addison Wesley.
* Grosvenor, J. & Morrison, K. & Pim, A., The PostScript font handReferences: A directory of Type 1 fonts, Addison Wesley.
* Health, Les & Faux, Ian, Phototypesetting, SITA Ltd.

* Holmes, Alan, Electronic Composition, Emblem Books Ltd.
* Joh W. Seybold, Fundamentals of Modern Photo Composition.
* Karow, Peter, Digital Typefaces: Description and formats, Springer-Verlag
* Knuth, Donal E., Computers & Typesetting/B: Tex: The Program, Addison Wesley
* Knuth, Donal E., Computers & Typesetting/E: Computer Modern Typefaces, Addison Wesley
* Knuth, Donal E., The Metafont book, Addison Wesley
* Knuth, Donal E., The Tex book, Addison Wesley
* Lamport, L., Latex: A document preparation system, ed2, Addison Wesley.
* Leslie, G.Health & Faux, Ian, Introductory Phototype Setting, GATF.
* Philips, A., Computer Peripherals and Typesetting, HMSO.
* Photo Composing Machines: A Survey of Users Views, British Printing Industries Federation.
* Shapre, Charles, Electronic Composition: A Guide to the Revolution in typesetting, GATF
* Sharma, M.C., Desktop Publishing on PC, BPB Publications, New Delhi.
* Soblick Herman, M.A., Photo Composition Methods and equipment, Guad Publishing Co., New York.
* Wilson-Davies, K. & Bate J.St.J. & Card M., Desktop Publishing, Publisher's Guide Series, Blue Print, London.

PRN/IEE/S/211 ELECTRONICS LABORATORY

1. Familiarization with Electronic Components like R, L, C and active devices.
2. Familiarization with Electronic Workshop Tools and their use. Soldering Practice.
3. Study of the Characteristic of PN-Junction Diode, Clipper, Clamper, Rectifier circuits and Zener regulators.
4. Characteristics of BJT (CE mode).
5. Study of a CE Amplifier.
6. Studies on the applications of operation amplifier - voltage follower, summer, integrator, differentiator, astable multivibrator.
7. Timer-555 : Monostable and astable multivibrator using 555.

PRN/S/212 GRAPHIC DESIGN AND LAYOUT LABORATORY

A complete design and layout of magazine /periodicals/brochure/leaflet/booklet is to be submitted at the end using following steps

1. .Fundamentals of design principles, Introduction to design and page layout softwares like QuarkXpress, Freehand, Indesign etc
2. The Interface palettes and toolbox
3. Creating Boxes: Intro to Boxes, Auto Create Text Box, Create Text/Picture Boxes, Import/export Text, Highlighting/deleting Text,
4. Formatting Text : Preference Palette, Changing Fonts, Size and Resize, Type Styles, Color/shades, Kerning Type, Tracking Words, Horizontal/vertical Scaling, Smart Quotes,Text BaseLines , Text Orientation, Convert Text to Box
5. Working With Lines and Creating Pictures : Create Picture Box, Resize Picture Box,

Import Pictures, Resizing Pictures Within a Box, Cropping Pictures, Rotating Picture Boxes, Rotating Pictures Within Box, Skewing Pictures Within Box, Flipping a Picture, Modifying Color and Shade of Pictures, Contrast Settings to Pictures, Custom Halftone Screens, Listing and Updating Picture Paths

6. Multiple Items: Select Multiple Items, Duplicate/step and Repeat , Group and Ungroup Items, Lock Items, Stacking Order of Items, Space and Align Items, Anchor Images Into Text

7. Text and Images: Measurement Palette, Text Over Images, Wrap Text Around Image/box, Clipping Paths, Runaround, Special Clipping Effects, Rotate/skew and Flip Text/Box, Text Inside Image Shapes

8. Beziers: Introduction to Beziers

9. Formatting Paragraphs: Alignment, Leading, Indents, Hanging Indents, Paragraph Spacing, Drop Cap' Insert Rule Above/below, Tab Inserts, Widow and Orphan Line Control, Hyphenation and Justification

10. Tables : Create New Table, Table Placement, Resizing Rows and Columns, Insert/Delete Columns and Rows, Convert Tables to Text, Creating Tables in a Web Document

11. Style Sheets: Create New Style Sheet, Paragraph Based on Existing, Apply a Style Sheet, Append Style Sheets, Compare Style Sheets

12. Master Pages: Create New Master Pages, Format and Apply Master Pages, Modify Master GuidesSetting Web Page Properties, Number Pages, Linking Text with Master Pages

13. Working With Color: Overview Of Color Models, Colors Palette, Create New Color , Edit/duplicate/delete Colors, Re-color Text, Re-color Frame/gap, Re-color Box , Color Blends

14. Layers: Intro to Layers Palette, Creating New Layers, Arranging Layers, Merge Layers, Determine Item Layer, Creating Items on a Layer, Moving Items to Different Layer Locking Items on Layers

15. Libraries: Create Library, Add/delete Library Items

16. References: Create a Book, Add/delete Chapters, Status Columns, Page Numbering Books, Synchronize Chapters, Print Chapters, Create New List, Build and Preview List

References :

* Mortimer Pamela, Document Design Primer, GATF
* Blanchard Russell W., Graphic Design, Prentice-Hall, Inc.
* Croy Peter, Graphic design and reproduction techniques, Focal Press

PRN/S/213 GRAPHIC REPRODUCTION LABORATORY

1. Study of different darkroom equipments
2. Study of developing solution
3. Procedure and handling the film, exposing, processing and drying
4. Preparation of line negative
5. Production of positives by contact printing
6. Preparation of halftone
7. Preparation of continuous tone bromide photograph using Enlarger

8. Retouching
9. Densitometric analysis
10. Digital reproduction photography
11. Digital inputting of transmission originals using transparency scanner

PRN/S/214 DIGITAL TYPESETTING LABORATORY

1. Getting acquainted with a digital typesetting environment: Equipments and softwares used.
2. Generating digital type faces, font manipulation
3. Paragraph setting, text alignment and pagination.
4. Tabulation and columns, indexing
5. Scientific and multilingual word processing.
6. Text and image integration: OLE and other techniques
7. Page composition utilities: macros, search and replace routines etc.
8. Text file format and file exchange.
9. Designing a text editing software.
10. Programming and control of output devices (eg. DMP, Laserprinter etc)

Second Year Second Semester

PRN/Math/T/221 MATHEMATICS-IVR

Sequence and infinite series, convergent and divergent series, comparison tests, D'Alembert's ratio test, Cauchy's root test.
Fourier Series, Fourier integrals, Dirichlet's condition, odd and even functions, Half range series.
Vector Calculus: Vectors, position vectors, addition and subtraction of vectors, components of a vector, scalar and vector products of two vectors scalar and vector triple products application to mechanics, Work done by a force, linear velocity in terms of angular velocity. Differentiation of a vector point functions, Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, Stokes, Gauss and Green's theorems (without proofs) with applications.

PRN/T/222 PRINTING MACHINE DESIGN

Basic idea of machine design, analysis, itemization, empericism, approximation and synthesis, design decision.
Permanent and detachable fastening devices, bolts, nuts, screw, keys, pin and retainers, their types and appropriate applications. Threaded joints, types and causes of threaded failures; Bolts without and with preloading; joints using gaskets.
Torque transmitting elements: Shaft couplings, pulleys - their types and design features. Kinematic analysis of spur and bevel gears, worms and worm wheels. Specification and selection of bearings. Simple structure and foundation equipment.
Basic idea of design & analysis, Concepts of fits & tolerances, design of typical machine elements, Design & drawing of gear box, worm, worm wheel, stop-valve, journal

bearing, clutch, etc.
Design aspects of sheetfed offset and web offset printing machines.

PRN/T/223 CONTROL APPLICATION IN PRINTING

Basic control concepts. Types of control systems, sequential modulating and feedback control. Benefits from feedback control, examples.
Use of Laplace transforms for analysis liner systems. Modelling of dynamic systems (electric motors, springmass dashpot system, ovens). Dynamic behaviour of closed loop systems. Temperature control. Position and velocity control. Concept of stability and compensation.
Control components. Transducers and sensors. Actuators (thyristor, controlled motors, stepper motors, pneumatic and hydraulic actuators). Control amplifiers, PID controller, relays and contactors.
Motor control, control application in printing industry. Application of sequential for starting and interlocking of motors. Other application of sequential control for printing and packaging machinery. Programmable logic controllers.

PRN/T/224 PACKAGING TECHNIQUES-I

Introduction: Definition; Packaging criteria: appearance, protection against chemical and physical hazards, functions regarding end use performance and machine performance, cost and cost effectiveness and disposability.
Packaging Materials, Properties And Packaging Forms: Wood: properties, decay and preservation of woods, forms of wood; Paper and paper boards: properties, types and their applications; Corrugated boards; Glass: properties, kind of glasses, glass package forms, their finishes and closers; Metals and Foils: Properties and uses, package forms; Polymers: Types, their properties and applications; laminates, fibers; adhesives: properties, kinds and their applications. Aerosols. Generals packaging forms: bag, pouch, blisters, strip, collapsible tubes, cans.
Packaging Production: Manufacturing and fabrication processes: Injection molding, blow molding, thermoforming, rotational molding, extrusion, compression molding; Lamination: processes and their applications; Labeling; Varnishing; Decorating: vacuum metallizing, electroless and electrolytic plating; filling; sealing; Cartoning: die cutting and punching.
Food packaging: Food decay, methods of food preservations; Aseptic packaging: definition, sterilization methods.

References:
* Evans, C.W. John, Trends in Paper and Paperboard Converting, Lockwood Trade Journal Co.
* Handbook of Package Design Research, Walter Stern Wiley Intascience.
* Hankn, Joseph F., Handbook of Package Engineering, McGraw Hill Co.
* Long, Robert P., Package Printing, Graphic Magazines.
* McGuive, Patric E., Packaging and Paper Converting, Palmerton Publishing Co., New York.

* Paine, F.A., Fundamentals of Packaging, Brookside Press Ltd., London.
* Paine, F.A., The Packaging Media, Blackie & Sons Ltd., London.
* Patne, A.M., Development in Binding and Packaging, MIPT, Pune.
* Plastics Engineering Handbook, The Society of Plastics Industry Inc., VNR, New York.
* Sutnar, Ladislav, Package Design: The Force of Visual Selling, Arts Inc., New York.

PRN/T/225 PRINTING MATERIAL SCIENCE-II

Atomic structure and bonding in materials, Structure of materials: Crystal systems, unit cells and space lattice; determination of structures of simple crystals by X-ray diffraction; Miller indices for planes and directions, Fick's laws of diffusion, doping of semiconductors and surface hardening of metals.
Introduction to organic chemistry, Hydrocarbons, Alcohols, Fatty acids, Amines & Amides.
Polymers: classification, polymerization, structure and properties, additives for polymer products, processing and application, Introduction to photopolymers,
Liquids & suspensions, emulsions, surfactants, adhesives & their general properties.
Pigments and dye staffs, oils, resins, solvents etc.
Composites, Alloys, Corrosion and environmental degradation of materials (metals, ceramics and polymers).

Reference:
* Handbook of Plastics
* R.H. Leach, Printing Ink Manual

PRN/T/226 PRINTING SURFACE PREPARATION

An introduction to different types of plates used in lithography, Flow chart of plate making procedures, details of plate graining, basic properties of the colloidal coatings, Surface chemistry of the plate coatings: colloidal coatings, diazo and photo polymers; the Albumen process of plate making, the deep-etch process of plate making, Wipe-on process of plate making, P.S. plate making, Bi-metal plate making, waterless plate making for lithography, Introduction to Computer-to-plate Technology

References:
* Photolithography; B.E. Tory, Graphic Arts Monthly, Chicago.
* Lithographers Manual, GATF.
* Advances in Printing Plate Technology, PIRA.
* The Complete Guide to Waterless Printing,; John O'Rourke, Quantum Resources Inc.

PRN/S/221 PRINTING MACHINE DESIGN AND DRAWING LABORATORY

1. Design and drawing of shafts.
2. Design and drawing of pulleys.
3. Design and drawing of different types of gears.

4. Design and drawing of printing cylinders.
5. Design and drawing of different types of rollers used in printing machines.
6. Design and drawing of bearings, clutch, etc.
7. Design and drawing of delivery grippers used in sheet fed machines.
8. Design and drawing of front lays and side lays used in sheet fed machines.

PRN/S/222 MECHANICAL SYSTEMS LABORATORY

1. Study of different types of Cams/followers (Spatial cam, ecentric cam, Mate cam, Cylinder cam, etc.) used commonly in printing machines and their related equipments.
2. Study of the basic principle of dampening system in offset machines.
3. Study of the sheet transport system used in offset machines.
4. Study of the inking system used in offset machines.
5. Study of web tension in offset press.
6. Study of Weissenburg effect of visco-elastic substances.
7. Study of double ecentric bearings used on the blanket cylinder journal.
8. Study of the differential gear tooth meshing.
9. Determination of shore hardness of different types of rubber material and to compare with IRHD.
10. Study of different types of mechanical properties of printing materials.
11. Study of different types of rheological properties of printing materials.

PRN/S/223 PRINTING SURFACE PREPARATION LABORATORY

1. Graining of the Al plate and grain measurement.
2. Anodizing of the Al plate.
3. Imposition of the negative and positive films for black and white and colour jobs.
4. Preparation of the offset plate using Egg-Albumen process.
5. Preparation of the offset plate using Deep-etch (Gum, Glue, PVA) process.
6. Preparation of the offset plate using wipe-on process.
7. Preparation of the P.S. plate for offset process.
8. Preparation of the nylo plate for letter press and flexography.
9. Some study on the quality control devices used for quality control purpose.

PRN/S/224 BOOK PRINTING LABORATORY

1. Analysis of existing book works and planning for a new.
2. Layout and structure of a book.
3. Page composition: Typesetting and pagination control
4. Graphic elements.
5. Indexing
6. House style
7. Bar coding, Book numbering (ISBN), Cataloging.
8. Proofing.
9. Plate making.
10. Printing.

Third Year First Semester

PRN/CSE/T/311 DATABASE MANAGEMENT SYSTEM

Linear lists-arrays, linked lists, stacks and queues. Trees - binary trees, binary search trees, multiway trees. Graphs. Strings. Searching and sorting techniques. File structures - sequential, relative, indexed - sequential, direct.
Broad introduction to database management systems and the design, implementation and applications of databases. Topics include an overview of DBMS architectures; concepts and implementations of the rotational models; SQL; database design and modeling techniques, and issue such as recovery, concurrency, physical implementation concerns and performance and management aspects. Alternative approaches to design database systems (for example object oriented or extended relational systems); distributed databases; database machines; and database interfaces and languages.

PRN/Gen/T/312 ENGINEERING ECONOMICS

Introduction - want -- activity - satisfaction of wants. Resource planning and distribution in economic systems. Laissez fair and socialism.
Factors of production and concept of optimum. Laws of return. Demand - elasticity of demand - supply and industrial cost. Money - value of money - Quantity theory - inflation and deflation. Pricing under various market scenarios.
Banking - role of commercial banks - credit and its importance in industrial financing - source of financing; Reserve bank and its functions.
Business organizations - Proprietorship - Partnership -Jointstock companies, insurance; Business combinations.
Markets: monopoly, duopoly, oligopoly, monopolistic competition, perfect competition.
Industrial record keeping; double entry system - journal - ledger - trial balance; Cashbook. Preparation of final accounts, trading, profit and loss accounts and balance sheets. Simple study of balance.
Service industries and international trade.

References:
* Bhattacharyya, Asish K., Financial Accounting for Business Managers, Prentice Hall
* Samuelson, Paul A. & Nordhaus, William D., Econimics, McGraw Hill.

PRN/T/313 FLUID MECHANICS

Fluid Properties: Relation between stress and strain rate for Newtonian fluids Hydrostatics, buoyancy, manometry, Concept of local and convective accelerations; control volume analysis for mass, momentum and energy conservation, Differential equations of continuity and momentum (Euler's equation of motion); concept of fluid rotation, stream function, potential function; Bernoulli's equation and its applications, Qualitative ideas of boundary layers and its separation; streamlined and bluff bodies; drag and lift forces, Fully-developed pipe flow; laminar and turbulent flows; friction factor; Darcy Weisbach relation; Moody's friction chart; losses in pipe fittings; flow

measurements using venturimeter and orifice plates, Dimensional analysis; similitude and concept of dynamic similarity; importance of dimensionless numbers in model studies. Rheological models and equations, plastic, pseudo plastics, dilatant and thixotropic substances. Visco-elastic fluids and visco-elasticity of printing materials. Effect of rheological properties of inks, polymers etc. Flow of non-Newtonian fluids in ducts. Flow of non-Newtonian fluids through annular gap. Weissenberg effect.

PRN/T/314 OFFSET PRINTING MACHINES

Feeding: Sheet transport in sheet fed offset machines: different types of feeding, feed board control, front lays and side lays, feed board detectors, different types of insertion systems, grippers, intermediate sheet transport.
Printing Couples: the plate cylinder, the blanket cylinder, and the impression cylinder, cylinder arrangement, cylinder bearers, cylinder gears, the inking system, ink flow, ink metering, ink distribution, pyramid design, roller setting, the dampening system, blanket fitting, packing, and blanket tension.
Delivery systems: Infrared drying, UV drying, and sheet delivery control.
The perfector Press: Separate unit perfector press, Blanket-to-Blanket perfector press, and the Convertible press.
Press Lubrication: Gravity-fed lubrication, continuous lubrication, intermittent lubrication, Cascade lubrication, and Grease-gum lubrication.
Trouble Shooting: Paper problems, ink problems, plate problems, and print quality problems.

References:
* Lithography, Ian Faux, Blue Print.
* Printing Technology; Adams, Faux and Rieber,
* Lithographers Manual, GATF

PRN/T/315 COLOUR SCIENCE AND ENGINEERING

Fundamentals of Color, Importance of Definitions of color: Hue,Brightness and Lightness, Colorfulness and Saturation, Elementary Principles of Color, Elementary Principles of Color Reproduction, Color Measurement, Calculations of Tristimulus Values, Calculations of Selected Ordinates, Chromaticity Diagrams, CIE Color Spaces, Color-Difference Specification, Digitizing Color, Color Conversion and Separation, Tone Reproduction and Color Balance, Spectral Sensitivities for Color Separation, , Paper and Ink, Halftone dots- Murray-Davis and Yule-Nielson equations, Additivity and Proportionality of Densities, Mathematical Analysis of Color Correction, Neugebauer Equations, Four-Color Printing and the Black Printer, Color Management System, Color matching and mixing, Color proof

References:
* John A. C. Yule, Principles of Color Reproduction: Applied to photomechanical reproduction, color photography, and the ink, paper, and other related industries , GATF
* Phil Green, Understanding Digital Color, GATF Press

PRN/T/316 **PACKAGING TECHNIQUES-II**

Different types of distribution hazards - mechanical hazards, climatic hazards etc. Basic considerations for protection of packaged items. Theory of cushioning, application of stress analysis to packaging behavior. Optimum cushioning selection. Shock absorption. Different cushioning materials. Suspension systems of the packaged items. Impact vibration, design consideration for isolation of vibratory forces.
Evaluation and testing of package performance. Drop tester, inclined impact tester, Compression and vibration testing. Principle of accelerometer. Laboratory transport testing methods.
Economy of packaging, influence of moisture, protective functions. Dehumidification, humidity control and dehumidification methods Shelf life of packaged articles, accelerated testing method, half value period method some case studies. Application of computers in packaging. Safety and maintenance.

PRN/CSE/S/311 **DATABASE MANAGEMENT SYSTEM LABORATORY**

To supplement the theoretical course on "Database Management System".

PRN/S/312 **OFFSET PRINTING MACHINES LABORATORY**

1. Study of drive system of offset machine (both mechanical and electrical).
2. Study of feeding unit of the sheet fed machine (including sheet separation, feed board control, registration, etc.).
3. Blanket fixing and adjustment, plate fixing, cylinder adjustment, impression pressure setting, etc.
4. Roller setting (both inking and dampening systems), measurements of nip pressure, roller hardness, etc .
5. Measurements of surface temperature of rollers, and stresses induced in the rollers.
6. Study of the delivery unit (including sheet control, gripper setting, bay setting).
7. Study of the control unit of offset machine.
8. Study of the lubrication system of offset machine.
9. Study of the pneumatic system of offset machine.
10. Single colour printing and multicolour printing.

PRN/S/313 **COLOR AND TONE REPRODUCTION LABORATORY**

1. Introduction to editing and retouching softwares like Photoshop
2. Process Color separation using color charts
3. Color adjustment of images and densitometric measurements
4. Tonal adjustment of Images and densitometric measurement: Tone Reproduction Curve analysis
5. Histogram analysis and equalization
6. Gray Component Replacement and black separation
7. Unsharp masking and other masking, special effects
8. Color Management: calibration and characterization of monitor, scanner and digital

camera
9. Calibration and characterization of printer using Color Management profiling softwares
10. Integrating Color Management
11. Visual Color Evaluation

References:
* Adams and Weisburg, GATF Practical Guide of Color Management, GATF
* John A. C. Yule,Principles of Color Reproduction: Applied to photomechanical reproduction, color photography, and the ink, paper, and other related industries , GATF

PRN/S/314 PACKAGING TECHNIQUES LABORATORY

1. Pattern design of folding carton.
2. Folding carton design using AUTOCAD.
3. Die-cutting of folded carton.
4. Testing of glass container.
5. Hydrostatic pressure testing of plastic container.
6. Impact resistance test of LDPE/HDPE film.
7. Study of properties of different types of packaging materials like polymer films, foil, board, etc.
8. Use of lamination in packaging.
9. Drop testing and vibration testing of the folding carton using accelerometer.
10. Air and water permeability testing of packages.
11. Uses of hermetically sealing equipments.
12. Uses of filling machine, making of pouches, etc.

Third Year Second Semester

PRN/CSE/T/321 MICROPROCESSORS

Introduction to microprocessors and microcomputers. Microprocessor architecture. Addressing modes. Instruction set; instruction cycle and state transition diagrams. Machine language and assembly language programming. Supervisory systems for microprocessors.
Data transfer operations - programme controlled, synchronous, asynchronous and interrupt handling. Direct memory access.
Interfacing devices for parallel and serial devices. Asynchronous and synchronous communications, DMA; interrupt controller, timer, etc.
Applications of microprocessors, philosophy of microprocessors based system design with examples. System evaluation, development and debugging aids.

PRN/T/322 ESTIMATING AND COSTING

Definition of estimation and costing and their relationship, Different costing methods, Determination of direct and indirect cost of a printing job, Budgeting, Establishment of

budget centers, Cost of productive department, Budgeted hour cost rates, Estimating paper, ink, film and other chemicals, Job specifications, Estimation form, Depreciation, Working capital, Expense control and budgetary control.

References :
* Ruggles Philip Kent, Printing Estimating, Delmar Publishers.
* Adams J. Michael, Faux D. David, Rieber J. Lloyd, Printing Technology, Delmar Publishers

PRN/T/323 DIGITAL IMAGING

Introduction To Digital Imaging: Conventional vs digital images. Image capturing and outputting devices. Hardware and software interfaces.
Digital Images: Vector and bitmap graphics. Graphics adapters.
Digital Tone Reproduction Techniques: Digital half toning. Dithering. Grayscale images. Resolution and image quality. Image file formats and file exchange.
Optical Scanning and Digitizing Techniques: Types of Scanner. Scanner anatomy; Scanner characteristics; Optical Character Recognition techniques; Bar Codes; Scanner feature; Document imaging processor & it's recognition; CCD color Capture technique; image Enhancement technique; Image manipulation; Frame grabbing technique.
Imagesetters and Platesetters: Mechanisms, calibration. Outputting.
Raster Image Processor Technology (Rip): Raster: Glyph; Hardware & resolution dependency: Concept of BLIT; Stages of RIP; Imaging of a page,
Data Compression/Decompression Technique: Character distribution; Character repetition; High usage pattern; Positional redundancy; Huffman coding; Run-length encoding; Programmed Compression; Adaptive Compression; Non-lossy Image Compression; Lossy Image Compression like JPEG, MPEG, Fractals group.

References:
* Corrigan, J., Computer Graphics: Secrets and Solutions, BPB Publications, New Delhi.
* Dougherty, Edward R & Giardina, Charles R., Image Processing-Continuous to Discrete, Vol.I: Geometric, Transform and Statistical Methods., Prentice Hall, NJ, USA
* Eastman Kodak Co., The Colour Separation Scanner.
* Giardina, Charles R. & Dougherty, Edward R., Morphological methods in image and signal processing, Prentice Hall, NJ, USA
* Gonzalez, R.C. & Woods, R.E., Digital Image Processing, Pearson Education, Asia
* Jensen, John R., Introductory Digital Imageprocessing: A Remote Sensing Perspective, Prentice Hall, NJ, USA.
* Kang, Henry R., Digital Color Halftoning (SPIE PRESS Monograph Vol. PM68), SPIE--The International Society for Optical Engineering.
* Lau, Daniel L. and Arce, Gonzalo R., Modern Digital Halftoning, Marcel Dekker.
* Molla, Dr. R.K., Electronic Colour Separation, R.K.Printing and Publishing Co., West Virginia, USA
* Pratt, William K., Digital Image Processing, John Wiley & Sons, Inc.
* Sturge, J. & Walworth, V. & Shepp, A., Imaging Processes and Materials (Neblette's eighth edition), Van Nostrand Reinhold, NY, USA

PRN/T/324 FLEXO AND GRAVURE

Flexographic principle, Flexographic printing surfaces and generation and their materials and processes. Inking system, Ink composition, Flexographic presses, Floxographic printing problems.
Gravure principle, Gravure cylinder making processes and materials used, Gravure ink and their properties, Gravure presses, Gravure printing problems, use of these processes in packaging industry, Trends and the future.

References :
* Flexography primer, GATF
* Kasunich Cheryl L., Gravure primer, GATF
* Adams J. Michael, Faux D. David, Rieber J. Lloyd, Printing Technology, Delmar Publishers
* Eldred Nelson R., Chemistry for the Graphic Arts, GATF
* Eldred Nelson R. & Scarlett Terry, What the Printer should know about Ink, GATF

PRN/T/325 PLANNING AND FINISHING

Review of Print processes, colour planning, Paper grain direction and its impodance in planning, Imposition techniques, Introduction to Folding machines, Different folds and their selection, Knife folders and its settings, Buckle folders, Feeders exclusively for folding machines, Problems and calculations on folding, Cutting and Trimming, Significance of planning for converting customer specification to finished material, Conditions and limitations of a planner, Planning for web machines, Introduction to Binding, Saddle-stitch binding and its use, Smyth sewing and its specifications, different Side stitches,
Perfect binding & Spiral binding, Adhesive binding, Problem exercises on binding, Hard cover binding, Styles on Hard cover, Decorative works like Foil stamping, Gold-lining, etc.

References:
* Binding and Finishing,; Geoff Potter, Blue Print
* Printing Technology; Adams, Faux and Rieber
* Lithographers Manual, GATF

PRN/T/326 INK TECHNOLOGY

Nature of printing ink - visual characteristics, drying characteristics, adhesive nature, resistance properties.
Raw materials of printing inks: Pigments and dyestuffs, oils, solvents, resin, plasticisers, driers, waxes, surfactants, antioxidants and other additives, Letterpress inks. Lithographic inks, Flexographic inks, Gravure inks, Screen inks - General characteristics, Physical properties, drying mechanism, formulation, inks for specific end-use application (ink for different types of plastics, paper, metallic ink, fluorescent inks, stamp inks), ink related problems and possible solutions, fugitive ink. Future trends.

Radiation curable systems - Infra-red curing, ultra-violet curing, micro-wave and radio-frequency drying, electron-beam curing Radiation curable equipments, future trends.
Manufacturing of inks - Manufacturing process - mixing and milling equipments, manufacture of news inks. Handling, transportion and storage, future trends.
Health and safety aspects.
Ink Testing

References: R.H. Leach, Printing Ink Manual, Kluwer Academic Publishers

PRN/CSE/S/321 MICROPROCESSORS AND CONTROL LABORATORY

To supplement the theoretical course on "Microprocessors".

PRN/S/322 DIGITAL IMAGING LABORATORY

1. An introduction to digital imaging environments: Equipment and softwares used.
2. Vector and bitmap graphics.
3. Digital tone reproduction techniques.
4. Inputting and analyzing reflection and transmission originals through flatbed scanner.
5. Inputting and analyzing images through digital camera.
6. Image file formats and file exchange.
7. Optical character recognition systems.
8. Programming in Page Description Languages to various output devices for imaging control.
9. Imaging through computer to film/plate systems.
10. Optical and other controls in scanner and digital camera.

PRN/S/323 FLEXO AND GRAVURE LABORATORY

1. Preparation of flexographic stereo
2. Preparation of Gravure cylinder
3. Study of different parts of the flexographic machine
4. Study of different parts of the gravure machine
5. Setting different parts of the machines
6. Printing on different types of substrate
7. Study of different running on problems and trouble shooting
8. Machine maintenance

PRN/S/324 PLANNING AND FINISHING LABORATORY

1. Imposition scheme: Half-sheet works.
2. Imposition scheme: Sheet works.
3. Cutting and trimming.
4. Wire stitching.
5. Sewing
6. Spiral binding.

7. Comb binding.
8. Adhesive binding
9. Laminating
10. Case binding

Fourth Year First Semester

PRN/CSE/T/411 COMPUTER GRAPHICS

Analysis and synthesis of graphical information -pixel and vector graphic. Discussion of display devices, graphical and data structures, transformations. Interactive techniques. Characteristics of interactive input devices, light pens, tablets and scanners. Computer manipulation of two dimensional forms, three dimensional graphics, hidden lines, surface, perspective and shedding.

PRN/T/412 NEWS PAPER PRINTING TECHNIQUES

Work flow of a news paper house, Front-End Systems: Collection of text, pictures and graphics into the computer, pagination systems, colour systems, library systems (storage). Introduction to telecommunications, Output devices: PTS, Laser printer, Image setter, and CTP.
Web Offset Machines: Basic configuration of web offset presses, different types of reel stand and their elements, web tension control, web detector devices, web turner, web registration control, different types of web folder and ancillary systems such as mail room delivery, bundling, etc.
Handling of printing materials in news paper house.

References:
* Latest developments in newspaper technology, PIRA.
* Advances in Web Offset, PIRA.
* Web Offset Operating, GATF.
* Printing Technology, Adams, Faux and Rieber.

PRN/T/413 NONIMPACT PRINTING

Electrophotography: Introduction to electrophotography, alternative powder marking technologies, electrophotographic processes & subsystems. Related physics, development steps, two component development system, cascade development, magnetic brush development both insulative & conductive systems, monocomponent & liquid development, xerographic sensitometry, TESI, electro-graphic colour processes. photoelectric materials, Applications of electro-photography.
Inkjet Printing: Introduction to inkjet printing. Types of inkjet technologies. Continuous and drop on demand inkjets printers, Printhead design considerations, Inkjet inks: non-aqueous, aqueous, hot-melt inks, substrates: plain paper, coatings
Thermal Printing: Introduction to thermal printing technologies. Direct thermal and Dye-diffusion thermal transfer. Chemistry of thermal papers.

References:
* Lane, Earle, Electrophotography, And/or Pr.
* Scharfe, Merlin E., Electrophotography Principles and Optimization, John Wiley & Sons.
* Schein, L.B., Electrophotography, Laplacian Press; rev. 2nd edition.
* Shaffert, R.M., Electrophotography, Focal Press, London
* Springer Verlag, Electrophotography and Development Physics,
* Sturge, J. & Walworth, V. & Shepp, A., Imaging Processes and Materials (Neblette's eighth edition), Van Nostrand Reinhold, NY, USA

PRN/T/414 ELECTRONIC PUBLISHING SYSTEM

Fundamental Of Publishing: Computer assisted Publishing; Electronic Publishing; Database Publishing; Web publishing Readability & Legibility of text on screen & paper regarding Character, Formatting, Colour & Contrast, Dynamic text presentation.
Page Construction: Concepts of BOX & GLUES; Rules for breaking paragraph into lines; List of lines into pages; Basic principle of justification and Hyphenation procedures; Typographic markup languages as publishing standards like ASPIC, SGML system.
Document Development System: Direct Manipulation interfaces; Source language model; Task domain like Direct manipulation graphics editing, Graphics programming, Formatting & layout, Pre & Post processing, Imaging Files and interchanges, Annotations/ Narration & dynamic reading; Basic structure of a document development system and its application in the latest document imaging software.
Styles In Document Editing System: Static functionality & Dynamic functionality; Styles; Style rules; Style design issue; Document structure like Consistency of style, Caption Selection of fonts, Heading & Subheading with text matter; house style.
Publishing Management System: Publication representation; Publication environments; Publication node structure; Version management; Content objects & processing objects; Publication naming; Information sharing Hypertext and its principle.
Multimedia System: Application of multimedia in web publishing. Multimedia tools. Multimedia presentation and editing.

References:
* Card, M., Interfacing wordprocessors and phototypesetters, Blueprint, London.
* Goldfarb, Charles F & Rubinsky, Yuri (Contributor) The SGML Handbook, Clarendon Pr
* Musciano, C. & Kennedy, B., HTML and XHTML: The Definitive Guide, Shroff Publishers & Distributors Pvt. Ltd., Kolkata
* Steinmetz, Ralf & Nahrstedt, Klara, Multimedia: Computing, Communications, and applications, Pearson Education, Asia.

PRN/T/415 ELECTIVE-I

1. COLOR VISION AND COLORIMETRY
2. DIGITAL IMAGE PROCESSING
3. PUBLICATION PRINTING

4. SPECIALITY PRINTING TECHNIQUES

PRN/T/415A COLOR VISION AND COLORIMETRY

The Eye, Colorimetry, Visual Equivalence and Visual Matching, Uniform Color Scales, Visual Thresholds, Theories and Models of Color Vision.
Psychophysics: Hierarchy of Scales, Threshold Techniques, Matching Techniques, One-Dimensional Scaling, Multidimensional Scaling, Importance in Color Appearance Modeling, Munsell color, The Swedish Natural Color System (NCS), The Colorcurve System, Other Color Order Systems, Uses of Color Order Systems
Color-Appearance Phenomena: Simultaneous Contrast and Spreading, Color Constancy
Viewing Conditions: Configuration of the Viewing Field, Stimulus, Proximal Field Colorimetric Specification of the Viewing Field, Modes of Viewing, Illuminant and Illumination
Chromatic Adaptation, Computational Color Constancy
Color Appearance Models: CIELAB, Wrong von Kries Transform, ATD Model, LLAB Model, CIECAM97s, CIECAM02
Scattering and Absorption of Light (Phenomenological Theory) : Phenomenological Theory and Its Significance, Four-Flux Theory, Kubelka-Munk Theory, Hiding Power, Transparency, Principle of Spectral Evaluation Light Scattering and Absorption Depending on the Content of Coloring Material (Beer's Law, Scattering Interaction) Scattering and Pigment Content, Systematic Treatment of Pigment/ Achromatic Paste Mixing, Kubelka-Munk Functions of Pigment/Paste Mixture, Tinting Strength (Corpuscular Theory), Mie Theory
Determination of Hiding Power, Tinting Strength and Lightening Power

References:
* Günther Wyszecki, W. S. Stiles, Color Science
* Billmeyer and Saltzman's Principles of Color Technology,
* Hunt, Measuring Colour
* Volz H.G.,Industrial Color Testing

PRN/T/415B DIGITAL IMAGE PROCESSING

Digital Image Fundamentals: Digital image representation, elements of digital image processing systems. Sampling and quantization. Basic relationships between pixels. Imaging geometry.
Image Transform: Fourier transform, Two dimensional Fourier Transform, FFT, other separable image transform.
Image Enhancement: Spatial domain model, Frequency domain model, Enhancement by point processing, spatial filtering, enhancement in frequency domain. Colour image processing.
Image Restoration: Degradation model, Diagonalization of circulant and block-circulant matrices. Algebraic approach to restoration. Inverse filtering. Least mean square filter.
Image Segmentation: Detection of discontinuities, Edge linking and boundary detection. Thresholding. Region-oriented segmentation.

Restoration and Description: Representation schemes, Boundary descriptors, Regional descriptors.
Recognition and Interpretation: Elements of image analysis. Pattern and pattern classes.

References:
* Giardina, Charles R. & Dougherty, Edward R., Morphological methods in image and signal processing, Prentice Hall, NJ, USA
* Gonzalez, R.C. & Woods, R.E., Digital Image Processing, Pearson Education, Asia
* Jensen, John R., Introductory Digital Imageprocessing: A Remote Sensing Perspective, Prentice Hall, NJ, USA.

PRN/T/415C PUBLICATION PRINTING

References: Standard and non-standard format of a book, copy preparation, Typography, Designing the text, Preparing illustrations, Preparing covers and jackets, Typesetting the text, originating and making up the illustrations, Arranging for final films and CRC, Proofing the cover or jacket, Choosing and using paper, Printing the book (printing processes and print quality control), Inks, Binding styles, Finishing operations, ISBN standards, Bar code, Organizing packing, Dispatch and distribution.
Magazines: Definition, Types. Business plan for starting a magazine, Developing the magazine, Editorial concepts, Article editing, Selection of write-ups, photographs and arts, Production planning, Wraps, Inserts and tip-ins, Different types of cover, Layout, Printing, Binding and finishing, Magazine circulation, Copyright act.

References :
* Peacock John, Book Production, Blueprint publishing.
* Click J. William and Baird Russell N., Magazine Editing and Production
* Wharton John, Managing Magazine Publishing, Blueprint Publishing
* Baird Russell N., Magazine Production

PRN/T/415D SPECIALITY PRINTING TECHNIQUES

Different types of speciality printing, Functions, Anti-counterfeiting features, Currency printing, Stamp printing, Cheque printing, Map printing, MICR, Hologram, PCB, Semiconductor lithography, Advance printing techniques
References :
1. Moreau Wayne M., Semiconductor lithography : Principles, practices and materials, Plenum Press
2. Saxby Graham, Practical Holography, Prentice-Hall
3. Boss hart C. Walter, Printed Circuit Boards, Tata McGraw-Hill Publishing

PRN/CSE/S/411 COMPUTER GRAPHICS LABORATORY

To supplement the theoretical course on "Computer Graphics".

PRN/S/412 SEMINAR

Two seminar presentations on the current topics in Printing Industry is required for each students.

PRN/S/413 INDUSTRIAL TRAINING

A report to be submitted by the students at the end of training as per directive given by the assigned teacher.

PRN/S/414 PROJECT-I

Topic of project to be selected jointly by the assigned teacher and the student. A typed project report in duplicate is due at the end of the semester.

Fourth Year Second Semester

PRN/CSE/T/421 DATA COMMUNICATIONS & NETWORKING

Introduction to the concepts and principles of computer networks. The nature of communications media and signaling methods, analog and digital transmission; data link protocols, protocol proof techniques; routing, broadcasting, multicasting; connection, disconnection and crash recovery protocols; internetworking and security; and network analysis and design using graph theory and queuing theory.

PRN/T/422 INDUSTRIAL MANAGEMENT

Introduction to management problem, types of manufacture, planning, analysis and control aspects in industries. Types of business ownerships, means of financing and business combinations. Organisation structures. committee, authority, responsibility, duty and span of control.
Plant location, building and physical facilities. Plant layout, machineries and materials. Product development and standarisation. Production planning and control, production forecasting and scheduling; network techniques. Gantt chart, CPM, PERT etc.
Workstudy, job evaluation and merit rating. Purchase system and inventory control. Maintenance and replacement policies for machines and equipment. Decision making theories. Break even analysis; cost benefit analysis, evaluation of financial and managerial efficiencies. introduction to operation research techniques. Industrial humanics and labour compensation. Personnel management provisions of industrial legislations in India; wage, salary. Welfare; safety provisions and trade union acts.
Marketing as an intergrative discipline; Market planning (theory X and Y). Methods of market segmentations, Introduction to reasons of buying and effects on market strategies. Consumer Vs. Industrial marketing. Suitable use of market research in printing industries.
Management techniques and abilities; General management analysis and decision making.
Corporate planning and control: corporate objectives, planning, organisations and applications. Analysis of companies in the printing and packaging industries. Change of company policy with change of technology. Reproduction work, approval and

modification of design; drawing of material schedule. Production planning; routing, interrelation of routing; route sheets; master schedule, machine loads and load charts. Laws, rules and regulations. Contracts of different nature.
Effect on packaging on marketing. Understanding the relationship between marketing and the industries. Market planning, understanding the market, the consumer and the market, marketing processes, the concept of marketing mix, new product development, distribution, productional mix, sales promotion, selling, pricing.

PRN/T/423 ENVIRONMENTAL SCIENCE

Overview of air pollution control strategy, Factors affecting control approach selection, Engineering analysis of air pollution problems.
Particulate control Technology: modification of particulate characteristics by different processes, settling chambers, cyclone separators, different types of filters, electrostatic precipitators, and wet scrubbers.
Characteristics and analysis of the sewage: Need for analysis, main characteristics of the sewage, Biochemical characteristics, aerobic and anaerobic decomposition.
Treatment of sewage and disposal: Screens, Grit chambers, Sewage sedimentation and chemical precipitation, biological treatment, sludge treatment and disposal.
Sound pollution and Control technique in Printing and packaging industry; Health hazards in Printing and Packaging industry.

References:
* Water supply and waste water engineering; B.S.N. Raju, Tata McGraw Hill Publishing Company, New Delhi, 2000.
* Air Pollution Control Technology; Robert M. Bethea, Van Nostrand Reinhold Company, New York, 1978.

PRN/T/424 QUALITY CONTROL IN PRINTING INDUSTRY

Conceptual aspect of quality and quality printing, defect detection versus defect prevention, establishment of the process capability via sampling and statistics, the use of statistical process control (SPC) tools, Overview of Six Sigma, control charts for variables, additional SPC techniques for variables, fundamentals of probability, control charts for attributes, lot-by-lot acceptance sampling by attributes, acceptance sampling systems, reliability, and management and planning. The substantial use of probability and statistical techniques is reduced to simple mathematics or is developed in the form of tables and charts.
Management role in creating quality environment, densitometry for measurement, ANSI standards on color printing, use of quality control devices for process control, and case studies on planning and implementing quality improvement programs in various printing environments.
Quality Assurance of Print Materials-ink testing, Short term, Long term, press performance and dry print performance tests for ink,, paper and other substrate testing.
Optimizing the Press Process Control
Digital Workflow: Advantages of Digital Technology , Film vs. Digital File , Standards

in Graphic Arts Open vs. Proprietary Systems, Types of Standards : ISO, ANSI, CGATS, CIE, ICC, Published Characterizations of Print ProcessesSWOP ,SNAP GRACoLProofing in the Graphic Arts, The Proofing Cycle , Traditional Proofs, Digital Proofs, Dye-Sublimation & Thermal Wax Proofers, Toner Proofers, Ink-Jet Proofers, Halftone Digital Proofers, Soft Proofing, Remote Proofing Document Management, , Job Tickets and Tracking, Press and Post-Press Control, Tasks in a Digital Production Workflow, Creation, Preflight, Image Capture, Page Preparation, File Repair, Image Swapping , Imposition, Trapping, Proofing, Hold for Approval, Raster Image Processing, Output/Imaging , Backup/Archiving , Information Systems Create Logic Blocks That Fit Your Structure, Task Integration and Location.

References:
* Ric withers, Digital Workflow, 2000
* Apfelberg H.L. and Apfelberg M.J., Implementing Quality Management in the Graphic Arts, GATF

PRN/T/425 ELECTIVE-II

1. ADVERTISING
2. COLOR MANAGEMENT SYSTEMS
3. LASER TECHNOLOGY
4. PACKAGE PRINTING

PRN/T/425A ADVERTISING

Introduction to advertising: Advertising and other communication methods; Role of advertising in public relations.
Types of advertising: Consumer product advertising; Industrial product advertising; Government advertising/ public service advertising; Financial advertising; Industrial or corporate advertising.
Planning and Managing Advertising Campaign: Budgeting and campaign execution; copy testing; Evaluation of advertising.
Advertising management: The publication advertising department; The Corporate advertising department; The advertising agency.
Advertising Production: Copy concept, copy structure, essential of a copy, creative approaches and styles, copy testing criteria, types of copy testing, validity and reliability of copy test. Advertising design, layout, visualization, principles of advertising design, contribution of visual elements, what to picture, how to choose color, test of a good layout, production of print advertising.

References:
* Rathore, B.S., Advertising Management, Animalaya Publishing, Howre.
* Schiffman, Leon G. & Konark, Leslie Lajar, Consumer Behavior, Prentice Hall Inc.
* Wright, John S.; Warner Daniel S.; Winter, Wills L.; Jr. & Zeigle Sharilyn K., Advertising, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

PRN/T/425B COLOR MANAGEMENT SYSTEMS

The need for color management systems and their architectures, Closed-loop color, Color space conversion, Characterization and calibration of devices, Color Standards, Color notation systems, Calculations of Colorimetric Quality Factor, Color processing of digital photographs, Color gamut calculations and mapping, Color management in digital film post-production. Creating and evaluating device Profiles, Color Management Tools.

References:
* Rich Adams and Joshua Weisberg, GATF Practical Guide to Color Management, GATF Press
* Phil Green, Color Engineering, GATF

PRN/T/425C LASER TECHNOLOGY

Introduction to Laser: Light and laser. Application of laser in Printing and Packaging industry.
Lasers: Types of lasers. Gas lasers, Solid state lasers, ruby laser and other kinds of lasers.
Production of laser: Population inversion. High energy lasers.
Laser applications: Laser machining: cutting, drilling, welding, marking. Exposure through laser. Usage in laser printer, imagesetter, drum scanner. Laser diecutting. Laser Gravure.
Holography:
Principles of holography: Introduction to holography. Light sources for holography. Basic types of hologram. Color holography. Materials, exposure and processing.
Practical display holography: Making a hologram. Single-beam techniques. 360 degree holograms. Introducing further beams and other holograms. Holographic stereograms. Holograms in color. Embossed holograms.
Lasers and safety. The Fourier approach to image formation.

References:
* Saxby, Graham, Practical Holography, Prentice Hall, New York.

PRN/T/425D PACKAGE PRINTING

Functions of the package, Different types of package, Package design, Packaging materials and how they are printed, Uses of different printing processes, Quality control in packages, Package inks and their properties, Finishing operations, Bar codes, Holograms, Troubleshooting, Trends and the future

References :
* Eldred Nelson R., Package Printing, Jelmar Publishing Co., Inc., NY

PRN/S/421 GENERAL VIVA-VOCE

Based on all the theoretical and sessional subjects.

PRN/S/422 MATERIAL TESTING AND QUALITY CONTROL LABORATORY

Material Testing:
1. Analysis of ink - chemical and instrumental techniques.
2. Pigment testing - size analysis - by microscope and centrifuge, Grind gauge to measure dispersion, Resistance tests - Resistance against acid, alkali, wax, soap, plasticised bleed, deep freeze etc.
3. Resin testing - acid value, hydroxyl value, solubility, melting range, color
4. Varnish and oil - iodine number, saponification no., water content, refractive index, diene value.
5. Solvent - Boiling range, relative density, flash point, aromatic content.
6. Short term ink testing - dispersion, viscosity, flow, strength, hue, opacity gloss.
7. Long term ink testing - Drying time and setting time.
8. Press performance test and printability.
9. Dry Print Performance tests - resistance tests, adhesion flexibility, slip, blocking, set-off, strike-through
10. Paper testing - Physical testing - grammage, thickness, density, smoothness, porosity, sizing. Strength testing -tensile strength, bursting strength etc.
11. Polymer testing - instrumental and chemical tests for indentification and quantification.
12. Ink formulation using spectrophotometer

Quality Control: Measurement and control of print quality
viz.
1. Print Contrast
2. Solid Ink Density
3. Hue error
4. Greyness
5. Sequential priorities of multi-color print
6. Trapping, etc. using Densitometers

References:
* R.H. Leach, Printing Ink Manual, Kluwer Academic Publishers

PRN/S/423 ELECTRONIC PUBLISHING SYSTEM LABORATORY

1. An introduction to electronic publishing environments: equipment, software used.
2. Mark-up languages and their utilities.
3. Graphics animation, morphing, tweening.
4. Audio input and editing.
5. Video input and editing
6. Multimedia editing
7. Analyzing various web publishing tools.
8. Web designing and web publishing.
9. Aspects of presentation slides and other electronic communication aids.
10. Working with server side languages.

(Ceramic Engineering)

(Syllabus)

Engineering mathematics II

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SN	CONTENTS
1	**Matrices:** Rank of a matrix, rank-nullity theorem; System of linear equations; ~~Symmetric, skew-symmetric and orthogonal matrices;~~ Eigenvalues and eigenvectors; ~~Diagonalization of matrices~~; Cayley-Hamilton Theorem, ~~and Orthogonal transformation.~~
2	**First order ordinary differential equations:** Linear and Bernoulli's equations, Exact equations, ~~Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.~~
3	**Ordinary differential equations of higher orders:** Linear Differential Equations of Higher order with constant coefficients, ~~Simultaneous Linear Differential Equations~~, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, ~~Cauchy-Euler equation;~~ ~~Power series solutions including Legendre differential equation and Bessel differential equations.~~
4	**Partial Differential Equations – First order:** Order and Degree, Formation; Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, ~~Charpit's method~~, Standard forms.
5	**Partial Differential Equations– Higher order:** Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates ~~including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.~~

Advanced Engineering Mathematics – I

(65)

SN	Contents	Hours
1	**Numerical Methods–1:** Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange'sformulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.	10
2	**Numerical Methods–2:** Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.	08
3	**Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.	10
4	**Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).	7
5	**Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.	5
	Total	40

Technical Communication

64

SN	Contents	Hours
1	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4
2	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Readingand comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
3	**Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
4	**Advanced Technical Writing**- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8

Managerial Economics and Financial Accounting

SN	Contents	Hours
1	**Basic economic concepts-** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	4
2	**Demand and Supply analysis-** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
3	**Production and Cost analysis-** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
4	**Market structure and pricing theory-** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
5	**Financial statement analysis-** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	Total	**26**

(63)

Electronics measurement & Instrumentation

(62)

SN	Contents	Hours
1	**Theory of errors:** Accuracy & precision, repeatability, limits of errors, systematic & random errors modeling of errors, probable error & standard deviation, Gaussian error analysis, combination of errors.	6
2	**Electronic Instruments for measuring basic parameters:** Electronic voltmeter, electronic multimeters, digital voltmeter, component measuring instruments, Q meter, vector impedance meter, RF power & voltage measurements, measurement of frequency. Introduction to shielding & grounding.	6
3	**Oscilloscopes:** CRT construction, basic CRO circuits, CRO probes, oscilloscope techniques of measurement of frequency, phase angle and time delay, Types of Oscilloscopes: Multibeam, multi trace, storage & sampling, oscilloscopes, curve tracers.	6
4	**Signal generation:** Sine wave generators, frequency synthesized signal generators, sweep frequency generators. Signal Analysis: Measurement technique, wave analyzers, frequency – selective wave analyser, heterodyne wave analyser, harmonic distortion analyser, spectrum analyser.	5
5	**Transducers:** Introduction, classification, selection criteria, characteristics, construction, working principles, Application of Transducers- RTD, thermocouples, thermistors, LVDT, RVDT, strain gauges, bourdon tubes, bellows, diaphragms, seismic accelerometers, tachogenerators, load cell, piezoelectric transducers, ultrasonic flow meters.	5
	Total	**28**

Introduction to Ceramics,

(64)

SN	Contents	Hours
1	**Introduction to Ceramics:** Definition, classification and scope of ceramics, ceramics versus metals and organics, historical perspective on the development of ceramics and ceramic industries. advanced ceramics versus traditional ceramics.Refractories, whitewares, cement, etc. Elementary ideas of their manufacture and applications. Basic glass processing, container glass, fibre glass, speciality glass products, glassceramics, glass microspheres, laminated glass, photochrome and photo sensitive glass modern / high tech ceramics, high tech functions and functional ceramics, structural ceramics, electrical and electronic ceramics, chemical and nuclear ceramics, bio-ceramics, ceramic membranes, artificial gems and ceramics, aerospace and other strategic application.	8
2	**Forming of ceramics and powder consolidation method**: Introduction, characteristics of solid particles, particle shapes, size, equivalent particle diameter, surface area, average particle size & size distribution.	5
3	**Binders & Additives:** Packing of particles, additives in forming processes, selection of additives; solvent, binder, plasticizers, deflocculants and lubricant.	5
4	**Dry and semidry pressing methods:** Dry and semidry pressing methods, die compaction and isostaticcompaction,Casting methods: slip casting, pressure casting and tape casting.Plastic forming method: extrusion and injection molding.	5
5	**Drying &Calcination:** Drying of cast or extruded articles, binder removal, calcinations & affecting factors.Sintering: Introduction to sintering of ceramics, hot and iso-static processing of ceramics.	5
	Total	28

Ceramic Raw Materials and Characterization (60)

SN	Contents	Hours
1	**Rocks Types:** Various types of rocks; igneous, sedimentary and metamorphic, Structures rocks: Textures, Structures and classification of above rocks, Origin of igneous, sedimentary and metamorphic rocks,Geology and its utility in ceramic industry.	6
2	**Ceramic Minerals:** Description and classification of various minerals based on their chemical compositions, Physical properties and occurrence.Brief idea on processing of synthetic raw materials: Bayer process, Calcined Alumina, Tabular Alumina, Fused Alumina, Sea-water Magnesia, Zircon and Zirconia, Titania, Magnesio-Aluminate Spinel, Fumed Silica etc. Application& limitations: The application areas and limitations of synthetic raw materials.	5
3	**Ceramic Raw materials:**Importance, use and limitations of natural raw materials in refractories, whitewares, cement, potteries, and glass ceramic Industries; Bauxite, Limestone, Chromite, Magnesite, Dolomite, Fluorite, Graphite, Gypsum, Haematite, Kaolinite, Fireclay, Ball clay, Montmorillonite, Magnetite, NephelineSyenite, Microcline, Feldspars (soda, potash, lime), Pyrophyllite, Quartz, Quartzite, Sillimanite, Kyanite, Andalusite, Talc, Wollastonite, Zircon, Beryl, Mica, Vermicullite, Silica sand etc.	5
4	**Optical Properties:**Optical activity, Polarizing microscope, Isotropic and anisotropic minerals, Bi-referingence,Pleo-chroism, Propagation of light through uni-axial and bi-axial minerals, Extinction, Cleavage and interference figures, Beck's effect. Optical microscope: Systematic description of minerals under polarizing microscope.	6
5	**Chromatography:** Introduction, Paper and thin layer chromatography, Liquid chromatography, Types of liquid chromatography, Column and detection systems. Effect of heat on different raw materials: Differential thermal analysis (DTA), thermo gravimetric analysis (TGA), thermal analysis, Differential Scanning Calorimetry (DSC), Factors affecting the phase transformations with suitable examples, Dilatometry–basic principles, instrumentations and case study in ceramic applications.	6
	Total	**28**

Thermodynamics and phase Equilibria

59

SN	Contents	Hours
1	**Introduction:** Basic Terminology and concepts, Brief introduction to laws of thermodynamics, concept of states of matter, intensive and extensive properties of systems, thermal and statistical entropy.Auxiliary Functions: Thermodynamic functions, Maxwell's equations and their applications in solution of problems, thermodynamics cycles.	6
2	**Phase Equilibria:** Component, Solubility limit, phases, microstructure, phase equilibria, binary isomorphous systems, interpretation of phase diagrams, lever rule, development of microstructure on isomorphous alloys, mechanical properties of isomorphous alloys, binary eutectic systems	5
3	Thermodynamic stability of Materials. Equilibrium diagrams having Intermediate phases &compound, eutectoid and peritectic reactions, congruent phase transformation, ternary phase diagrams.Ellingham diagram and its importance, application of electrochemical series in ceramics.	6
4	**Behavior of gases:** Equation of state of gas, internal energy of real gas, Ideal gases, experimental determination of heat capacities, quasi adiabatic process, Ruchhardts method of measuring gama, velocity of longitudinal waves, kinetic theory of ideal gas.	5
5	**Chemical equilibrium:** Daltons law, semi permeable membrane, Gibbs theorem, Gibbs Helmoltz equation entropy of a mixture of inert ideal gases, Gibbs function of a mixture of inert ideal gases, chemical equilibrium, condition for mechanical stability. Thermodynamics equations for a phase: Thermodynamics equations for a phase, chemical potentials, degree of reactions, equation of reaction equilibrium.	6
	Total	**28**

particle and fluide mechanics.

SN	Contents	Hours
1	**Particle Mechanics:** Theory of crushing and grinding crushers grinders and ultra fine grinders. Close and open circuit grinding, selection of equipment and power requirement. Screening & Separation: Sieve analysis, cumulative and differential plots. Industrial screening equipment's, Separation based on size, shape, density and surface properties.	6
2	**Separators and Filters:** Law of motion of single particle sedimentation, free and hindered settling. Thickener and settling chambers, Flotation, rotary fluids, centrifuge, cyclone, electrostatic and magnetic separators, Pneumatic and hydraulic transportation of solids, Jansen's equation, conveyors, bins, silos and hoppers, different equipment for mixing of fluids and solids, mixing index. Filtration: Flow through filter cake and medium, plate and frame filters, centrifugal filters, filter media, filter aids, washing of filtercakes, selection of filtration equipment's.	6
3	**Basic Definitions and Fluid Properties :** Definition of fluid, incompressible and compressible fluids, fluid as a continuum, mass, density, specific weight, relative density, specific volume, bulk modulus, velocity of sound ideal fluid viscosity, Newtonian and Non-Newtonian fluid, Kinematic viscosity. Effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation's, fluid states; general differential equation, hydrostatics manometry, fluid forces on submerged surfaces, curved surfaces, aerostatics, Isothermal atmosphere, polytropic atmosphere.	6
4	**Kinematics and Conservation of Mass:** Flow classifications, fluid velocity and acceleration, streamlines and the stream function, path lines and rotational flow, flownet, Laplace equation. Conservation of mass and the continuity equation for three dimensions, equation of motion, Euler's equation of motion, Bernoulli's equation, applications of Bernoulli's Pitot tube,	5
5	**The Boundary Layer:** Description of the boundary layer, boundary layer thickness boundary layer separation and control, The Prandtl boundary layer equation, flow round a body, drag skin friction drag, pressure drag, combined skin friction & pressure drag (Profile drag) wave drag, lift induced drag, variation of drug co- efficient with Reynolds's number.	5

Materials Science.

57

SN	Contents	Hours
1	**Crystallography:** Introduction, space lattice, Bravais lattice, basis, unit cell, lattice parameters, crystal structure, factor affecting ceramic crystal structures, Miller indices, crystal symmetry.Different crystal structures: BCC, FCC and HCP, study of AX, A_mX_p, and $A_mB_nX_p$ type ceramic crystal structures.	7
2	**Type of standard crystal structures:** Introduction, structure of silicates (orthosilicates, pyrosilicates, single chain, double chain, sheet and network silicates), structure of kaolinite clay $Al_2(OH)_4(Si_2O_5)$, talc $Mg_3(OH)_2(Si_2O_5)_2$, mica $KAl_2(OH)_2(AlSi_3O_{10})$ andzeolite. Polymers and Liquid crystals:Polymer and liquid crystals.	5
3	**Crystal imperfection:** Classification of defects in natural crystals: Point, line, plane, electronic imperfections, transient imperfection, points defects: thermodynamics of point defects, lattice vacancies, Schottky defects, Frenkel defects, extrinsic vacancies and colour centers. Dislocations: Introduction, edge and screw dislocations, Burger vector, slip systems, energy of dislocations, theory of dislocation, Interaction between dislocations.	6
4	**Mechanical Properties and Diffusion:** Mechanism of plastic deformation, strengthening mechanism, recovery recrystallization and grain growth, dislocations in crystal growth. Imperfection Techniques, Effect: Effects of crystal imperfection on electronics, optical and mechanical properties and technique for imperfect determination and controlling the crystal imperfection in crystal growth.Diffusion: Diffusion, diffusion mechanisms, steady-state diffusion, non-steady-state diffusion, factors that influence diffusion.	5
5	**Optical properties:** Interaction of electromagnetic waves with matter, absorption, reflection, transmittance and colour of materials.Photoconductivity: Introduction, photo conducting materials,electronic transition in photoconductors absorption and excitation, trapping and capture, simple model of a photoconductor. Luminescence: Introduction, model for luminescence in sulphide phosphors, thallium activated alkali halides. Electroluminescence.	5
	Total	**28**

Advanced Engineering Math II

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Complex Analysis:** Differentiability and Analytic functions, Cauchy-Riemann equations (Cartesian and Polar form), Harmonic functions. Conformal mapping. Complex Line integral, M-L inequality, Cauchy theorem, Morera's theorem, Cauchy integral formulae, Taylor series and Laurent series. Singularities and Zeros, residues at poles and infinity, residues at isolated essential singular point, Cauchy residue theorem, evaluation of real definite integrals and improper integrals.	13
3	**Special Functions:** Legendre's function, Rodrigues formula, generating function, Simple recurrence relations, orthogonal property. Bessel's functions of first and second kind, generating functions, simple recurrence relations, orthogonal property.	12
	Total	**26**

56

Managerial Economics and Financial Accounting

55

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Basic economic concepts-** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	3
3	**Demand and Supply analysis-** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
4	**Production and Cost analysis-** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
5	**Market structure and pricing theory-** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
6	**Financial statement analysis-** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	Total	**26**

Technical Communication

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	3
3	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Readingand comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
4	**Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
5	**Advanced Technical Writing**- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	Total	26

Theory of Solid mechanics

53

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Stress-strain:** Tensile, compressive, shear stress and strain, stress-strain diagram. Stress-strain Relationships: Hooke's law, Poisson's ratio, elastic constants and their relationships for isotropic homogeneous material, thermal stresses.	5
3	Composites bars, simple elastic, plastic and visco-elastic behavior of common materials in tension and compression test, concept of factor of safety and permissible stress.Mohr's circle of stress and strain, a brief theory of elastic failures.	6
4	Types of load, types of beams, Introduction to bending moment and shear force diagrams. bending stress and shear stress distributions in various sections viz. circular, hollow, T etc.Torsional shear stress in solid, hollow and stepped circular shafts; concept of equivalent bending and equivalent twisting moment.	5
5	**Vibration:** Degree of freedom for dynamic analysis, single degree of freedom system, force-displacement relation: linearly elastic system and inelastic system, damping force. Equation of motion: external force, application of Newton's second law of motion, dynamic equilibrium stiffness, damping and mass components, mass-spring damper systems. Free Vibration: Un-damped, viscously damped free vibration: types of motion, under-damped systems, decay of motion, free vibration tests.	6
6	**Friction:** Laws of static, dynamic and rolling friction, dry & viscous friction, inclined plane and screw jack, friction axis, bearing and theory of film lubrication, Clutches. Introduction to thin and thick walled cylinders, energy methods (Castigliano's Theorems).	5
	Total	28

Ceramic analysis and instrumentation

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Crystallography:** Continuous and characteristic emission of X-rays, absorption filters, diffraction, Bragg's Law powder and single crystal X-ray diffractometer, atomic scattering factor,geometrical structure factor. Indexing of diffraction patterns, determination of structure and lattice parameters. Applications of XRD & XRF: Applications of X-ray diffraction in ceramic systems, X-ray fluorescence (XRF).	7
3	**Spectroscopic Analysis:** Introduction, absorption and reflection techniques, atomic techniques: emission, absorption and fluorescence, Photo acoustic spectroscopy, Microwave spectroscopy and mass spectrometers. Atomic Absorption spectrometer, IR, FTIR and Raman– Basic principle, instrumentation and analysis of data.	8
4	**Gas and Liquid Analysis:** Infrared and ultraviolet absorption analyzers, Paramagnetic oxygen analyzers, Thermal conductivity analyzers, Chemical luminescence analyzers and flame photometer and its uses in analysis. PH meters, conductivity meter, analyzers for measurement of ammonia, silica, sodium and dissolved oxygen.	7
5	**Electron Microscopy**: Principle, construction and operation of scanning electron microscope (SEM), Principle construction and working of transmission electron microscope (TEM), electron diffraction, bright field and dark field images, SAD, sample preparation of ceramic materials for SEM, TEM and EPMA.	8
6	**Particle Size:** Light scattering, Coulter counter, sieving, X-ray line broadening and sedimentation method for particle size measurements, surface area and porosity measurements, BET surface area measurements, gas adsorption, Mercury porosimetry and pycnometry for porosity of powders.	9

Electric properties of materials

(51)

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Band Theory & Solids:** Conductivity of metals, Mattheisen's rule, Sommer field model, Band theory of solids, Kronig-Penny model, origin of energy gap, Brillouin zones, distinction between metals, insulators and semiconductors, direct experimental evidence for band structure. Semiconductivity, temperature dependence of carrier concentration, factor that affect carrier mobility, Hall effect.	6
3	**Magnetic Materials:** Classification of magnetic materials, ferromagnetism, diamagnetism and paramagnetism, origin of ferromagnetism and hysteresis loop, domain and magnetic anisotropy, magnetostriction, ferrimagnetic compounds, spinel, garnet.Properties: High temperature susceptibilities, Specific heat and thermal conductivity. Soft and hard magnetic materials and their applications.	6
4	**Polarization & Dielectric Materials In Static Fields:** Introduction. Polar and non-polar dielectrics, polarization of dielectric, Clausius-Mossoti equation, Measurement of dielectric constant.	4
5	**Dielectric Material In Dynamic Fields:** Polarisabiltiy, frequency and temperature dependence of polarisability, dielectric relaxation. Dielectric losses and Breakdown of dielectrics, Electrets. Losses atmicrowave, IR & Optical frequencies.	4
6	**Piezoelectric:** Piezoelectric effect: Introduction, theory and application of piezoelectric crystals. Ferroelectric effect: Introduction, ferroelectric crystals, change in crystal structure during polarization, theory of ferro-electricity, ferroelectric domain, difference between ferroelectric and ferromagnetic domain, use of ferroelectric materials.	7
	Total	28

Heat and mass transfer

50

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Conduction:** Heat transfer by conduction. Fourier's law, thermal resistances in series, conduction through infinites slab, thick walled cylinder and thick sphere, variation of conductivity with temperature. Convection: Heat transfer through liquid. Newton's law, film coefficient, natural and forced, overall heat transfer coefficient, heat transfer coefficient based on inside and outside areas, dirt and foul factors, elementary concepts of dimensionless numbers, their use in predicting film coefficient, heat transfer to liquid under laminar and turbulent flows, forced convection outside tubes. Radiation and furnace: Stefan-Boltzmann law, emissivity and absorbability, black and grey bodies, view factors, gas radiation, radiant heat transfer in glass melting.	6
3	**Furnaces:** solid, liquid and gaseous fuels, their feeding devices, primary and secondary air for combustion, complete and partial combustion, calculation of radiant heat transfer in furnaces. Fuel gas: analysis and its utility, purpose of furnace linings and higher chimneys, application to steam boilers.	5
4	**Heat Exchanger:** Shell and tube heat exchangers, baffles, design of heat exchanger and their relative advantages, multi pass heat exchangers. LMTD: Mean temperature difference in co-current and countercurrent flows, LMTD correction factor for multi pass heat exchanger, plate heat exchanger, current, counter current and cross-flow heat exchangers.	5
5	**Diffusion and Diffusivity:** Fick's law, mass and molar rates of flow, different velocities and fluxes under static and moving co-ordinate system, concentration gradients in dimensional concurrentand counter current flows, two film theory, analogy between mass momentum and heat transfer. Mass transfer co-efficients: Mass transfer co-efficients, their experimental determination, use of dimensionless numbers, Sherwood, Lewis, Schmidt numbers. Absorption: absorption and desorption in packed beds and in plate columns, relative advantages.	6
6	**Drying:** Internal flow of moisture within the solids surface evaporation drying shrinkage estimation of drying rates and achievement of maximum drying rate.Dryers: Detail study of the various driers used in ceramic industries; tray driers, tunnel driers drum driers vacuum driers and spray driers.	5

Fuels, Furnaces and Pyrometers, 49

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**History of kilns:** Traditional & energy efficient kilns.	4
3	**Fuel:** Characteristics & classification of solid, liquid & gaseous fuels, solid fuels-wood& charcoals, coal, liquid -petroleum fuels, gaseous fuels –coal gas, water gas, producer gas, natural gas, LPG. Electrical Heating: nichrome & kanthal, super kanthal, silicon carbide, molybdenum silicide. Selection of fuels: selection of fuels in ceramic Industries.	6
4	**Combustion & Heat saving devices:** Chemistry of combustion, types of combustion, combustion of solids, liquid and gaseous fuels, fuels-flame characteristics, fluidized bed, combustion devices. regenerators, recuperators.	5
5	**Firing:** Firing of ceramic wares, ideal firing curves, setting of wares in kilns, operation & trouble shooting in ceramic kilns. Temperature measuring devices i.e. thermocouple, radiation and optical pyrometer.	5
6	**Kilns:** Classification, design and description of different types of furnaces used in ceramic Industries as downdraft kiln, Shuttle kiln, chamber furnace, tunnel kiln, Roller kilns, glass tank furnace, rotary kiln, energy auditing & management in oil & gas fired kilns. Heat balance in shuttle & tunnel kilns.	7
	Total	28

Cement Technology

48

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Origin and development of cement and cementatious materials. Batch preparation: Raw materials and their classification, selection of raw materials, crushing of lime stone and other calcareous materials, proportioning of raw materials, grinding of raw materials and preparation of raw meal, blending & beneficiations of raw materials.	5
3	**Lime:** Different classes of building lime and their properties. Processing: Burning of raw mix, reactions occurring in cement making at different temperature, preheater and pre-calcinators in cement industry, heat recovery devices and waste heat utilization, Firingsystem and kiln residence time. Working of rotary kiln and clinkering reactions, clinker coolers. Clinker and their storage, cement grinding mills, cement storage and silos, conveying, packing and dispatch of cement, cement packing machines. Dust and dust collection in cement industries.	6
4	**Concrete & Testing:** Introduction, classification, properties of concrete, grades of concrete, advantages and disadvantages of concrete, concept of quality control, concrete industry, challengesfaced by concrete industries. Testing of cement.	5
5	**Types of cements**: Different types of cement:- Quick setting cement, low heat cement, blast furnace slag cement, trief cement , sorrel cement, white and colored cement, Iron ore cement, oil well cement, hydrophobic cement, water proof cement. Masonry cement, expanding and self stressingcement, sulphate resisting cement, super sulphate cement, high alumina and other refractory cements, refractorycastables, pozzolana and pozzolanic cements.	7
6	**Gypsum:** Gypsum, plaster of paris (POP), its properties and uses, manufacture of plaster of paris, setting and hardening of plaster of paris.	4
	Total	28

Data Base management System

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Introduction, need, purpose and goals of DBMS.DBMS architecture, concept of keys, generalisation and specialization. Introduction to relational data model, ER Modeling, relational algebra.	6
3	Conceptual data base design, theory of normalization. Primitive and composite data types, concept of physical and logical databases. Data abstraction and data independence,. Relational calculus	5
4	DDL and DML. Constraints assertions, views, data base security. Application Development using SQL: Host language interface, embedded SQL programming. GL's, Forms management and report writers. Stored procedures and triggers.	5
5	Physical data organization in sequential, indexed, random and hashed files. Inverted and multilist structures.	4
6	Transaction processing, concurrency control. Transaction model properties and state serializability. Lock base protocols, two phase locking, Log based recovery Management.	5

Glass - & Glass Ceramics

End Term Exam: 3 Hours

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Glass:** Definition of glass, model of glass structure, types and composition of glass, Glass constituents and batch ingredients, decolourisers and refining agents, batch calculation, batch preparation.	6
3	**Glass melting:** Fundamental of glass formation, factors that influence glass formation, Zachariasen's rules, kinetic & thermodynamic criteria for glass formation, nucleation and crystal growth, TTT diagram, structural models of silicate and non-silicate glasses, bridging and non-bridging oxygen, tank furnaces, feeding of glass batches, melting process, refining of glass, batch redox number, electric heating, cold top furnace, pot melting.	7
4	**Quality control of glasses:** control of compositions, measurement of density, thermal expansion, viscosity, liquid immiscibility and phase separation in glasses structural theories of liquid immiscibility, thermodynamics of liquid immiscibility, mechanism of phase separation, chemical durability of glass. Fabrication: pressed and blown wares, flat glass, tubing and bulbs, fiber glass.	8
5	**Defect:** Defect in glass, stones, seeds, cords and blisters, gas inclusion, entrapped gas in batch, decomposition of batch materials, bubbles from refractory, nucleation and growth of bubbles from a supersaturated, detection of gases contained in bubble, detection of vitreous inclusions, removal of vitreous inclusion, crystalline inclusion, batch stones, refractory inclusion.	7
6	**Glass–Ceramics:** Definition, production of glass-ceramics, description & application of various glass ceramics, types of glass ceramic; photosensitive lithium aluminum silicate, magnesium aluminum silicate, machinable glass ceramics, bio-active glass ceramics, sintered glass ceramics.	6
7	**Special Glasses:** Technology of making radiation shielding glasses, heat absorbing glasses, solder glasses. Optical properties of glass, optical glass, photosensitive glasses, coating of glass, colored glass including photochromic and electrochromic glass.	5
	Total	40

Pottery and Heavy clay ware Ceramics

45

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Red Clay (Terracotta) Technology-** Pre-historic back ground, raw-materials & their types, physical & chemical properties. Clay processing & body mixes, fabrication techniques for different red clay products. Drying & firing, kilns & Kiln construction. Classification of red clay (Terracotta) products and their qualities, common building bricks, roofing tiles. Value up-gradation of red clay products. Glazes & Glazing. Firing & Decoration techniques for red clay products.	8
3	**Plastic & Non Plastic Raw materials-**Clays geology & mineralogy, Ries classification, properties of clays- adsorption, cation exchange, flow properties, thixotropy, plasticity, permeability, green shrinkage & strength, fired shrinkage &strength;talc& steatite, pyrophyllite, silicon atom & its building silica, feldspar, nephelinesyenite, sillimanite, bone ash, wollastonite other fluxes-Li, Na, K, Mg, Ca, Ba &B compounds. Water, deflocculates, flocculants, organic binders, lubricants and sticking agents, drying aids, plaster of paris (POP).	9
4	**Winning & Purification of Clays:** Mining & winning of clays; china clay, sedimentary clays, machinery used in clay mining, treatment of clays.	5
5	**Action of Heat on Ceramic Raw-Materials:** changes, non-altering chemical composition, changes altering chemical composition, incomplete & complete reaction, melting, crystallization& glass formation, structure of glasses & glazes, phase diagram in ceramic bodies.	6
6	**Ceramic Bodies:** Composition of ceramic bodies, brick wares, stoneware, fine stoneware, white stoneware, electrical stoneware, earthenware, vitreous china, soft porcelain, bone china, hard porcelain, chemical porcelain, electrical porcelain.	7
7	**Methods of Fabrication:** Throwing, jiggering and jollying, soft plastic methods, extrusion methods, stiff-plastic methods.	4

Refractory I

44

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Definition of refractory, properties of refractories, classification of Refractory, Ingredient of refractory, manufacturing process and unit operation.	6
3	**Manufacture, properties, and application:** silica, high alumina, dolomite, Magnesite, zircon, zirconia refractory, fusion cast refractory, ceramic fiber and heat insulating refractory.	7
4	**Composite Refractories:** Alumina-carbon, magnesia-carbon, spinel, alumina-silicon carbide- carbon, zirconia-carbon.	6
5	**Properties and Measurement:** Chemical analysis, mineralogical analysis by X-ray diffraction, microscopic examination, bulk density and apparent Porosity, true density and true porosity, fusion point, permeability, cold crushing strength (CCS), refractory under load (RUL), hot modulus of rupture (H-MOR), pyrometric cone equivalent (P.C.E.), creep behavior, abrasion resistance, thermal shock resistance, thermal conductivity, thermal expansion and spalling, slag resistance.	8
6	**Refractory Applications:** Blast furnace refractories, refractories for steel making, ladle refractories, refractories for aluminum, copper industries, refractories for the refineries and circulating fluid beds, Refractories in cement industries, refractories in glass industries, petrochemical Industries.	8
7	**Reaction of Refractory:** slag, glasses, carbon monoxide, acids, alkalis, flue gases, corrosion of regenerator's refractory by flue gases.	4

Electroceramics

(43)

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Ceramic Capacitors:** Historical Background, Ferro Electricity in Capacitors Technology, Dielectric Properties of Multi-Phase systems, Basic Dielectric Materials, Varieties of Ceramic capacitor, Capacitor performance Parameters, Packaging of Ceramic Capacitors, Typical Ceramic Dielectric Compositions	6
3	**Piezo-electric and Electro-optic Ceramics:** Piezoelectric Ceramic, Ferroelectric ceramic, Electro optic Ceramic, Composition, Processing & Properties, Applications of Piezoelectric &Electro optic ceramic	5
4	**Magnetic Ceramics:** Spinal ferrites, Hexagonal ferrites, Rare earth Garnet, Processing & application in various fields	5
5	**Ceramic Sensors:** Theory & Transducer classification, Transition from theory to Practice, Future Prospects,Thermo-physical Properties : Thermo-physical Properties	5
6	**ZnOVaristors:** Varistors electrical characteristics, Varistor's Microstructure & Fabrication,Varistors equivalent circuit, Mechanics of Varistors behavior, Varistors applications.	5
7	**Ionically conducting ceramics:** Kroger Vink Notation used for atomic defects, formulation of reaction equations, defect equilibria and Kroger-Vink diagrams for different systems,Diffusion: Diffusion in stoichiometric and nonstoichiometric oxides.	6
8	**Superconductivity:** Superconductors, Meissner effect, types of superconductors, BCS theory for superconductivity, Synthesis, characteristics and applications of High Tc superconductors.	5
9	**Thick Film Technology:** Initial materials, processing, conductors, dielectrics, resisters, hybrids.	4

Refractory - II

32

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Introduction to monolithic refractories, advantages and disadvantages; classifications based on application techniques.	7
3	**Bonding Systems and Additives:** Various bonding systems, CaO-Al2O3 system, hydration of calcium aluminates, bonding mechanism of different binders, various additive systems; refractory castables and details of Conventional Castables	8
4	**Castables:** Low Cement Castables, Ultra Low Cement Castables, No Cement Castables, Self-Flow Castables, other monolithics like mortar, gunning mass, spraying mass, ramming mass, dry-vibratables, pumpable castables.	8
5	**Manufacturing:** Machinery and equipment for making unshaped refractories, chemical constituents and purity; raw materials and their selection, particle size distribution, discrete and continuous particle size distribution, Furnas, Andreassen-Andersen and Dinger-Funk model; batch preparation, mixing, processing and manufacturing.	8
6	**Properties & Applica:** Installation techniques, application, properties and speciali: of different castables systems, like alumina, alumina - gnesia, alumina spinel, magnesia, magnesia carbon, etc	8

Engineering Ceramics & Abrasives (41)

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Advanced ceramics for engineering application**-reliability consideration, toughening of Si-based ceramics by fiber reinforcement, laminated composite structures with enhanced fracture resistance. Carbide and nitride, ceramic bearing.	8
3	**Sialon** and other ceramics engineering applications, power generation, aerospace application, nuclear reactor. Ceramics for tribological application, ceramic cutting tools, porous ceramics and ceramic fibers.	9
4	**Ceramic materials** for energy system, extruded cordierite honeycomb ceramics for environmental application, ceramic matrix composite, intelligent ceramics, and decorative ceramics.	6
5	**Abrasive:** Abrasive operations, natural abrasives, abrasives like aluminum oxides, silicon carbide, diamond and boron nitride. Miscellaneous synthetic abrasives.	8
6	**Raw materials for abrasives,** their proportioning, processing, manufacture of abrasives, grinding wheels, their drying, firing and testing. The use of abrasives and grinding wheels in grinding, evaluation of abrasives products, loose abrasives operations, chemistry of grinding.	8
	Total	**40**

(20)

Ceramic Coating - Enamel & Glazes

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Enameling:** Brief description of raw materials used in enamel. Batch calculations of frit making, milling and slip preparation, preparation of metal parts, and applications of slip. Firing process, colored enamels, properties and defects of enamel coating.	7
3	**General information on Glaze:** Nature, origin and importance of ceramic glazes, ceramic glazes as a glassy state. Properties of glass, composing and optimization of glazes.	8
4	**Raw Materials:** Raw materials for acidic oxides, basic oxides, for simultaneously introducing basic oxides & acidic oxides, for amphoteric oxides. Auxiliary materials for opacifiers, binders, fixingagents, water as a glaze component, toxicity of raw materials, adhesive agents & stabilizers, selection of raw materials.	8
5	**Technology of Glaze:** Seger formula, glaze calculation based on pure raw materials and based on fritted glaze and mill additives, application of glazes, firing of glazes, cooling & tensions inglaze layer, coloring of glazes, molecular, colloidal and glaze staining, decolorization of glazes, matting of glazes, pacification of glazes.	8
6	**Classification of Glazes:** Classification, The nature of glazes, general properties of glazes based on body to be glazed, based on glaze composition.	8

properties of Ceramic materials II (39)

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Electrical Conductivity 1:** Electrical conduction phenomena, ionic conduction in crystal, Nernst- Einstein equation for diffusion and conductivity in ionic solids, applications of ionic conductors, electronic conduction in crystals, ionic conductance in glasses, absorption current, electrode polarization.	8
3	**Electrical Conductivity 2:** Temperature dependence, effect of composition, mix alkali effects, electronic conduction in glasses, non-stoichiometric, solute-controlled electronic conduction, band structure of zinc & copper oxide, valency controlled semiconductors, mixed conductors in poor conductors, polycrystalline ceramics.	8
4	**Dielectric Properties:** Electrical phenomena, dielectric constant of crystal & glasses, dielectricloss factor for crystal & glasses. Dielectric conductivity, poly crystalline & poly face ceramics, dielectric strength, ferro-electric ceramics.	8
5	**Magnetics Properties Phenomena:** Origin of interaction in ferrimagnetic materials, direct exchange interaction and super exchange interactions, double exchange Interaction. Ferrites; spinal ferrite, rare earth garnet and hexagonal ferrites, polycrystalline ferrites, effects of composition & grain size & porosity on the magnetic behavior.	8
6	**Optical Properties:** Electromagnetic waves in ceramics, refractive index & dispersion, reflection & refraction, scattering, refractive Index & dispersion in dielectric materials, boundary reflectance & surface gloss. Opacity & translucency, absorption & color, bands, color, Ligand-Field chemistry, colorants, ceramic stains, color specifications, lasers, phosphors, fiber optics.	8
	Total	41

material Science & Engineering

38

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Nano-Science:** Meaning of nano-particle, metal nano-clusters: magic numbers, theoretical modeling of nano-particles, geometric structure, electronic structure, reactivity, fluctuations, and magnetic clusters. Carbon, Diamond, Graphite, Fullerenes Carbon Nano tubes- methods of synthesis: R F plasma, chemical methods, thermolysis, pulsed laser methods.	8
3	**Polymer Structure:** Hydrocarbon Molecules, Polymer Molecules, Chemistry of Polymer molecules, Molecular weight, shape, Structure & Configuration. Polymer 2: Thermoplastic & Thermosetting Polymers, Co- Polymers, Polymer Crystallinity, Polymer Crystals, Defects in Polymers, Diffusion in Polymeric materials.	8
4	**Polymer's Characteristics, Applications, & Processing:** Stress – Strain behavior, Macroscopic Deformation, Viscoelastic Deformation, Viscoelastic Relaxation Modulus, Viscoelastic Creep, Fracture of Polymers, Characteristics polymers Viz Impact Strength, Fatigue, Tear Strength, Hardness. Mechanism of Deformation strengthening, Crystallization, Melting & Glass Transition Phenomena in Polymers Polymer types, Polymer synthesis & Processing, Polymer's applications.	9
5	**Composites:** Introduction, Particle reinforced composites: Large Particle composites, Dispersion strengthened Composites. Fiber Reinforced Composites: Influence of Fiber length, Fiber orientation, Applications. The fiber phase, The matrix phase, polymer matrix, metal matrix, ceramic matrix, carbon– carbon, hybrid composites, processing of fiber reinforced composites, structural composites.	8
6	**Corrosion & Degradation Of Materials:** Corrosion of Metals: Electro Chemical Consideration, Electrode Potential, Corrosion Rates, Passivity, Environmental effects, Forms of Quotation, Corrosion environments, Corrosion prevention: Corrosion prevention, Oxidation, Corrosion of Ceramic materials & Degradation of Polymers.	8
	Total	42

properties of Ceramic materials - 37

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Thermal Properties:** Introduction, heat capacity, density and thermal expansion of crystal, thermal expansion, density and thermal expansion of glasses. Effect of heat treatment, thermal expansion of composite bodies, effect of polymorphic transformation.	5
3	**Thermal & Compositional Stresses:** Thermal expansion & thermal stresses, temperature gradient & thermal stresses, micro-stresses, glaze stresses. Thermal shock, resistance to thermal shock & thermal spalling, thermally tempered glass, annealing, and chemical strengthening.	5
4	**Thermal Conduction Processes in Phonon :** Phonon conductivity of single phase crystalline, temperature dependence, influence of structure and composition of pure materials, boundary effect, impurities and solid solutions, effect of boundaries, conductivity of multiphase ceramics. Phonon conductivity of single-phase glasses, temperature dependence of glass conductivity, effect of compositions, photon conductivity, photon mean free path, temperature dependence.	7
5	**Viscous Flow,Plastic Deformation, and Creep:** Introduction, plastic deformation, creep deformation, viscous deformation. Plastic deformation: of rock salt, fluorite crystal and Al2O3, creep ofsingle crystal and polycrystalline ceramics.	4
6	**Elasticity, Anelasticity and Strength:** Fracture process, elastic deformation & elasticity, elastic moduli, anelasticity behavior, brittle fracture & crack propagation. Theoretical strength: Griffith-Orwan criteria, statistical nature of strength, strength & fracture surface, static fatigue, creep fracture, effect of microstructure.	6
	Total	28

Polymer Science & Engineering

(38)

1	**Introduction:** Objective, scope and outcome of the course.
2	**Chemistry of high polymers:** Degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness, Polymerization methods: addition, condensation and other newer techniques, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, azeotropic copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension, emulsion.
3	**Polymer Characterization:** Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights. polymercrystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.
4	**Synthesis and properties:** Thermoplastics polymers: PE, PP, PS, PVC, Polyesters, Acrylic, PU polymers, Engineering Plastics: Nylon, PC, PBT, PSU, PPO, ABS, Fluor polymers, Engineering Plastics: Nylon, PC, PBT, PSU, PPO, ABS, Fluor polymers, Thermosetting polymers: PF, MF, UF, epoxy, unsaturated polyester, alkyds, natural and synthetic rubbers: recovery of NR hydrocarbon from latex, SBR, nitrile, CR, CSM, EPDM, IIR, BR, silicone, TPE.
5	**Polymer Technology and Rheology:** Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, cross-linking and vulcanization. Newtonian and non-Newtonian fluids, flow equations, dependence of shear modulus on temperature, molecular/segmental deformations, Measurements of rheological parameters. Visco-elasticity-creep and stress relaxations, control of rheological characteristics, rubber curing in parallel plate viscometer, ODR and MDR.
6	**Polymer processing and testing:** Different types of molding, thermoforming, rubber processing in two-roll mill, internal mixer, Mechanical & electrical testing of polymers, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.

Ceramic Coating - Enamel Glazes

35

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Enameling:** Brief description of raw materials used in enamel. Batch calculations of frit making, milling and slip preparation, preparation of metal parts, and applications of slip. Firing process, colored enamels, properties and defects of enamel coating.	7
3	**General information on Glaze:** Nature, origin and importance of ceramic glazes, ceramic glazes as a glassy state. Properties of glass, composing and optimization of glazes.	8
4	**Raw Materials:** Raw materials for acidic oxides, basic oxides, for simultaneously introducing basic oxides & acidic oxides, for amphoteric oxides. Auxiliary materials for opacifiers, binders, fixingagents, water as a glaze component, toxicity of raw materials, adhesive agents & stabilizers, selection of raw materials.	8
5	**Technology of Glaze:** Seger formula, glaze calculation based on pure raw materials and based on fritted glaze and mill additives, application of glazes, firing of glazes, cooling & tensions inglaze layer, coloring of glazes, molecular, colloidal and glaze staining, decolorization of glazes, matting of glazes, pacification of glazes.	8
6	**Classification of Glazes:** Classification, The nature of glazes, general properties of glazes based on body to be glazed, based on glaze composition.	8

Refractory-II

34

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Introduction to monolithic refractories, advantages and disadvantages; classifications based on application techniques.	7
3	**Bonding Systems and Additives:** Various bonding systems, CaO-Al2O3 system, hydration of calcium aluminates, bonding mechanism of different binders, various additive systems; refractory castables and details of Conventional Castables	8
4	**Castables:** Low Cement Castables, Ultra Low Cement Castables, No Cement Castables, Self-Flow Castables, other monolithics like mortar, gunning mass, spraying mass, ramming mass, dry-vibratables, pumpable castables.	8
5	**Manufacturing:** Machinery and equipment for making unshaped refractories, chemical constituents and purity; raw materials and their selection, particles size distribution, discrete and continuous particle size distribution, Furnas, Andreassen-Andersen and Dinger-Funk model; batch preparation, mixing, processing and manufacturing.	8
6	**Properties & Applications:** Installation techniques, application, properties and specialties of different castables systems, like alumina, alumina - magnesia, alumina spinel, magnesia, magnesia carbon, etc	8

Traditional Ceramics processing Techniques

37

SN	Contents
1	**Introduction:** Objective, scope and outcome of the course.
2	**Ceramic Building Materials:** Common Bricks, Facing & Stock Bricks, Engineering Bricks, Blue Bricks, Hollow Bricks, Perforated Bricks, Hollow tiles, Glazed Bricks, Roofing Tiles, Flower Pots, Salt Glazed Stoneware Pipes, Floor Tiles, Wall Tiles, Exterior Decorated Tiles. Sanitary Earthen wares, Vitreous China Sanitary wares, Fireclay & Stoneware sanitary wares.
3	**Ceramics in Home:** Stoneware Table wares, Earthenware tableware vases etc, Semi-vitreous China wares, Hotel China wares, Bone china Dinnerware, Hard Porcelain tableware, Heat Resistant wares, Stoneware Kitchen wares, Art wares, Dental Porcelain.
4	**Chemical Ceramics:** Stoneware, Chemical Stoneware, White Chemical Stoneware, Chemical Porcelain, Carbon & Graphite Shapes, Delanium Carbon,& Graphite, Kemite & Karcite laboratory equipments& Filters.
5	**Engineering Wares:** Mullite Porcelain, Steatite Porcelain, Sintered Boron Carbide, Sintered Silicon Carbide, Thoria& Uranium Dioxide Ceramics. Fused Alumina Grinding Wheels, Ceramic Cutting Tools.
6	**Ceramics in Electrical Industries:** Low Tension Insulators, High Tension Insulator, High Temperature Insulators, Sparking Plug Insulators, High Frequency Ceramic Insulators, Low Loss Steatite, Alumina, Zircon & Cordierite Ceramics.

Advanced Ceramic processing Techniques. (32)

SN	Contents
1	**Introduction:** Objective, scope and outcome of the course.
2	**Science of Colloidal Processing:** Science of colloidal processing of ceramics: Introduction, types of colloids, attractive surface forces, electrostatic, steric and electrostatic stabilizations, structure of consolidated colloids. Rheology: Detailed study of rheology of ceramic systems, Vander waals forces between macroscopic bodies, effect of intervening media, lyophobic collides, Stabilization Phenomena: Electrostatic stabilization in double layer and surface charges, Repulsion between two double layers, Stability of electrostatically colloids, electrokinetic phenomena, polymeric stabilization.
3	**Sol-Gel Processing:** Polymeric gel route, metal alkoxides - preparation & its properties, sol gel process for metal alkoxides, sol-gel preparation techniques for colloidal gel & polymeric gel, Application of Sol-Gel: Application in thin film & coating, fiber & monolithices.
4	**Solid –State and Viscous sintering:** Sintering of polycrystalline & amorphous materials, Analysis of sintering: Theoretical analysis of sintering, numerical simulations of sintering, phenomenological sintering equations, Sintering stresses and its measurement.
5	**Powders synthesizing:** Powder characteristics, Powder preparation methods: Mechanical synthesis, mechnochemical synthesis, chemical methods, vapor phase reactions.
6	**Liquid Phase Sintering:** Introduction, elementary features of liqui phase sintering, microstructure produced by liquid phase sintering, stages in liquid Phase sintering: Stages in liquid phase sintering, controlling factors.

Chemistry (31)

CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship

CHEMICAL SCIENCES

Inorganic Chemistry

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).
3. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
4. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.
5. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
7. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.
10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.
11. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.
12. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Physical Chemistry:

1. Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.

2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.

3. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.

4. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems.

5. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.

6. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

8. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.

9. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.

10. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

12. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

13. Polymer chemistry: Molar masses; kinetics of polymerization.

14. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

Organic Chemistry

1. IUPAC nomenclature of organic molecules including regio- and stereoisomers.

2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.

3. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.

4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.

5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.

6. Common named reactions and rearrangements – applications in organic synthesis.

7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations.

8. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.

9. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic.

10. Pericyclic reactions – electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.

11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).

12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.

13. Structure determination of organic compounds by IR, UV-Vis, ^{1}H & ^{13}C NMR and Mass spectroscopic techniques.

Interdisciplinary topics

1. Chemistry in nanoscience and technology.
2. Catalysis and green chemistry.
3. Medicinal chemistry.
4. Supramolecular chemistry.
5. Environmental chemistry.

Physics

(28)

CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship

PHYSICAL SCIENCES

PART 'A' CORE

I. Mathematical Methods of Physics

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

II. Classical Mechanics

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics- moment of inertia tensor. Non-inertial frames and pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity- Lorentz transformations, relativistic kinematics and mass–energy equivalence.

III. Electromagnetic Theory

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields.

IV. Quantum Mechanics

Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time-independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli exclusion principle, spin-statistics connection.

V. Thermodynamic and Statistical Physics

Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Micro-canonical, canonical

and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.

VI. Electronics and Experimental Methods

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics.

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting,

PART 'B' ADVANCED

I. Mathematical Methods of Physics

Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using Runge-Kutta method. Finite difference methods. Tensors. Introductory group theory: SU(2), O(3).

II. Classical Mechanics

Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

III. Electromagnetic Theory

Dispersion relations in plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation- from moving charges and dipoles and retarded potentials.

IV. Quantum Mechanics

Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts, partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

V. Thermodynamic and Statistical Physics

First- and second-order phase transitions. Diamagnetism, paramagnetism, and ferromagnetism. Ising model. Bose-Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to nonequilibrium processes.

VI. Electronics and Experimental Methods

Linear and nonlinear curve fitting, chi-square test. Transducers (temperature, pressure/vacuum, magnetic fields, vibration, optical, and particle detectors). Measurement and control. Signal conditioning and recovery. Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering

and noise reduction, shielding and grounding. Fourier transforms, lock-in detector, box-car integrator, modulation techniques.

High frequency devices (including generators and detectors).

VII. Atomic & Molecular Physics

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

VIII. Condensed Matter Physics

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

IX. Nuclear and Particle Physics

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions.

Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

Mathematics

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CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship
COMMON SYLLABUS FOR PART 'B' AND 'C'
MATHEMATICAL SCIENCES
UNIT – 1

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.

Sequences and series, convergence, limsup, liminf.

Bolzano Weierstrass theorem, Heine Borel theorem.

Continuity, uniform continuity, differentiability, mean value theorem.

Sequences and series of functions, uniform convergence.

Riemann sums and Riemann integral, Improper Integrals.

Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.

Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.

Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations.

Algebra of matrices, rank and determinant of matrices, linear equations.

Eigenvalues and eigenvectors, Cayley-Hamilton theorem.

Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms.

Inner product spaces, orthonormal basis.

Quadratic forms, reduction and classification of quadratic forms

UNIT – 2

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations.

Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem.

Taylor series, Laurent series, calculus of residues.

Conformal mappings, Mobius transformations.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements.

Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain.

Polynomial rings and irreducibility criteria.

Fields, finite fields, field extensions, Galois Theory.

Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness and compactness.

UNIT – 3

Ordinary Differential Equations (ODEs):

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs.

Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis :

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and

Runge-Kutta methods.

Calculus of Variations:

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

Classical Mechanics:

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

UNIT – 4

Descriptive statistics, exploratory data analysis

Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws of large numbers, Central Limit theorems (i.i.d. case).
Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson and birth-and-death processes.

Standard discrete and continuous univariate distributions. sampling distributions, standard errors and asymptotic distributions, distribution of order statistics and range.

Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Gauss-Markov models, estimability of parameters, best linear unbiased estimators, confidence intervals, tests for linear hypotheses. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression.

Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction techniques: Principle component analysis, Discriminant analysis, Cluster analysis, Canonical correlation.

Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods.

Completely randomized designs, randomized block designs and Latin-square designs. Connectedness and orthogonality of block designs, BIBD. 2^K factorial experiments: confounding and construction.

Hazard function and failure rates, censoring and life testing, series and parallel systems.

Linear programming problem, simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.

All students are expected to answer questions from Unit I. Students in mathematics are expected to answer additional question from Unit II and III. Students with in statistics are expected to answer additional question from Unit IV.

Economics

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UNIVERSITY GRANTS COMMISSION
NET BUREAU

NET SYLLABUS

Subject: ECONOMICS **Code No.: 01**

Unit-1 : Micro Economics

- Theory of Consumer Behaviour
- Theory of Production and Costs
- Decision making under uncertainty Attitude towards Risk
- Game Theory – Non Cooperative games
- Market Structures, competitive and non-competitive equilibria and their efficiency properties
- Factor Pricing
- General Equilibrium Analysis
- Efficiency Criteria: Pareto-Optimality, Kaldor – Hicks and Wealth Maximization
- Welfare Economics: Fundamental Theorems , Social Welfare Function
- Asymmetric Information: Adverse Selection and Moral Hazard

Unit-2 : Macro Economics

- National Income: Concepts and Measurement
- Determination of output and employment: Classical & Keynesian Approach
- Consumption Function
- Investment Function
- Multiplier and Accelerator
- Demand for Money
- Supply of Money
- IS – LM Model Approach

- Inflation and Phillips Curve Analysis
- Business Cycles
- Monetary and Fiscal Policy
- Rational Expectation Hypothesis and its critique
-

Unit- 3 : Statistics and Econometrics

- Probability Theory: Concepts of probability, Distributions, Moments, Central Limit theorem
- Descriptive Statistics – Measures of Central tendency & dispersions, Correlation, Index Numbers
- Sampling methods & Sampling Distribution
- Statistical Inferences, Hypothesis testing
- Linear Regression Models and their properties – BLUE
- Identification Problem
- Simultaneous Equation Models – recursive and non-recursive
- Discrete choice models
- Time Series Analysis

Unit-4 : Mathematical Economics

- Sets, functions and continuity, sequence, series
- Differential Calculus and its Applications
- Linear Algebra – Matrices, Vector Spaces
- Static Optimization Problems and their applications
- Input-Output Model, Linear Programming
- Difference and Differential equations with applications

Unit-5 : International Economics

- International Trade: Basic concepts and analytical tools
- Theories of International Trade
- International Trade under imperfect competition
- Balance of Payments: Composition, Equilibrium and Disequilibrium and Adjustment Mechanisms
- Exchange Rate: Concepts and Theories
- Foreign Exchange Market and Arbitrage
- Gains from Trade, Terms of Trade, Trade Multiplier

- Tariff and Non-Tariff barriers to trade; Dumping
- GATT, WTO and Regional Trade Blocks; Trade Policy Issues
- IMF & World Bank

Unit-6 : Public Economics

- Market Failure and Remedial Measures: Asymmetric Information, Public Goods, Externality
- Regulation of Market – Collusion and Consumers' Welfare
- Public Revenue: Tax & Non-Tax Revenue, Direct & Indirect Taxes, Progressive and non-Progressive Taxation, Incidence and Effects of Taxation
- Public expenditure
- Public Debt and its management
- Public Budget and Budget Multiplier
- Fiscal Policy and its implications

Unit-7 : Money and Banking

- Components of Money Supply
- Central Bank
- Commercial Banking
- Instruments and Working of Monetary Policy
- Non-banking Financial Institutions
- Capital Market and its Regulation

Unit-8 : Growth and Development Economics

- Economic Growth and Economic Development
- Theories of Economic Development: Adam Smith, Ricardo, Marx, Schumpeter, Rostow, Balanced & Unbalanced growth, Big Push approach.
- Models of Economic Growth: Harrod-Domar, Solow, Robinson, Kaldor
- Technical progress – Disembodied & embodied; endogenous growth
- Indicators of Economic Development: PQLI, HDI, SDGs
- Poverty and Inequalities – Concepts and Measurement
- Social Sector Development: Health, Education, Gender

Unit-9 : Environmental Economics and Demography

- Environment as a Public Good
- Market Failure
- Coase Theorem
- Cost-Benefit Analysis and Compensation Criteria
- Valuation of Environmental Goods
- Theories of Population
- Concepts and Measures: Fertility, Morbidity, Mortality
- Age Structure, Demographic Dividend
- Life Table
- Migration

Unit-10 : Indian Economy

- Economic Growth in India: Pattern and Structure
- Agriculture: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Industry: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Services: Pattern & Structure of Growth, Major Challenges, Policy Responses
- Rural Development – Issues, Challenges & Policy Responses
- Urban Development – Issues, Challenges and Policy Responses.
- Foreign Trade: Structure and Direction, BOP, Flow of Foreign Capital, Trade Policies
- Infrastructure Development: Physical and Social; Public-Private Partnerships
- Reforms in Land, Labour and Capital Markets
- Centre-State Financial Relations and Finance Commissions of India; FRBM
- Poverty, Inequality & Unemployment

English (17)

UNIVERSITY GRANTS COMMISSION
NET BUREAU

NET SYLLABUS

Subject: English **Code No. : 30**

Unit –I : Drama

Unit –II : Poetry

Unit –III : Fiction, short story

Unit –IV : Non-Fictional Prose

NOTE: The first four units must also be tested through comprehension passages to assess critical reading, critical thinking and writing skills. These four units will cover all literatures in English.

Unit –V : Language: Basic concepts, theories and pedagogy. English in Use.

Unit –VI : English in India: history, evolution and futures

Unit –VII : Cultural Studies

Unit –VIII : Literary Criticism

Unit –IX : Literary Theory post World War II

Unit –X : Research Methods and Materials in English

Geology (16)

CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship

EARTH, ATMOSPHERIC, OCEAN AND PLANETARY SCIENCES

PAPER I (PART B)

1. The Earth and the Solar System:
Milky Way and the solar system. Modern theories on the origin of the Earth and other planetary bodies. Earth's orbital parameters, Kepler's laws of planetary motion, Geological Time Scale; Space and time scales of processes in the solid Earth, atmosphere and oceans. Radioactive isotopes and their applications. Meteorites Chemical composition and the Primary differentiation of the earth. Basic principles of stratigraphy. Theories about the origin of life and the nature of fossil record. Earth's gravity and magnetic fields and its thermal structure: Concept of Geoid and, spheroid; Isostasy.

2. Earth Materials, Surface Features and Processes: Gross composition and physical properties of important minerals and rocks; properties and processes responsible for mineral concentrations; nature and distribution of rocks and minerals in different units of the earth and different parts of India. Physiography of the Earth; weathering, erosion, transportation and deposition of Earth's material; formation of soil, sediments and sedimentary rocks; energy balance of the Earth's surface processes; physiographic features and river basins in India

3. Interior of the Earth, Deformation and Tectonics
Basic concepts of seismology and internal structure of the Earth. Physico-chemical and seismic properties of Earth's interior. Concepts of stress and strain. Behaviour of rocks under stress; Folds, joints and faults. Earthquakes – their causes and measurement. Interplate and intraplate seismicity. Paleomagnetism, sea floor spreading and plate tectonics.

4. Oceans and Atmosphere
Hypsography of the continents and ocean floor –continental shelf, slope, rise and abyssal plains. Physical and chemical properties of sea water and their spatial variations. Residence times of elements in sea water. Ocean currents, waves and tides, important current systems, thermohaline circulation and the oceanic conveyor belt. Major water masses of the world's oceans. Biological productivity in the oceans.

Motion of fluids, waves in atmospheric and oceanic systems. Atmospheric turbulence and boundary layer. Structure and chemical composition of the atmosphere, lapse rate and stability, scale height, geopotential, greenhouse gases and global warming. Cloud formation and precipitation processes, air- sea interactions on different space and time scales. Insolation and heat budget, radiation balance, general circulation of the atmosphere and ocean. Climatic and sea level changes on different time scales. Coupled ocean-atmosphere system, El Nino Southern Oscillation (ENSO). General weather systems of India, - Monsoon system, cyclone and jet stream, Western disturbances and severe local convective systems, distribution of precipitation over India.

Marine and atmospheric pollution, ozone depletion.

5. Environmental Earth Sciences
Properties of water; hydrological cycle; water resources and management. Energy resources, uses, degradation, alternatives and management; Ecology and biodiversity. Impact of use of energy and land on the environment. Exploitation and conservation of mineral and other natural resources. Natural hazards. Elements of Remote Sensing.

PAPER I (PART C)

I. GEOLOGY

1) MINERALOGY AND PETROLOGY:

Concept of point group, space group, reciprocal lattice, diffraction and imaging. Concepts of crystal field theory and mineralogical spectroscopy. Lattice defects (point, line and planar). Electrical, magnetic and optical properties of minerals. Bonding and crystal structures of common oxides, sulphides, and silicates. Transformation of minerals – polymorphism, polytypism, and polysomatism. Solid solution and exsolution.

Steady-state geotherms. Genesis, properties, emplacement and crystallization of magmas. Phase equilibrium studies of simple systems, effect of volatiles on melt equilibria. Magma-mixing, -mingling and -immiscibility.

Metamorphic structures and textures; isograds and facies. Mineral reactions with condensed phases, solid solutions, mixed volatile equilibria and thermobarometry. Metamorphism of pelites, mafic-ultra mafic rocks and siliceous dolomites. Material transport during metamorphism. P-T-t path in regional metamorphic terrains, plate tectonics and metamorphism.

Petrogenetic aspects of important rock suites of India, such as the Deccan Traps, layered intrusive complexes, anorthosites, carbonatites, charnockites, alkaline rocks, Kimberlites, ophiolites and granitoids.

2) STRUCTURAL GEOLOGY AND GEOTECTONICS:

Theory of stress and strain. Behaviour of rocks under stress. Mohr circle. Various states of stress and their representation by Mohr circles. Different types of failure and sliding criteria. Geometry and mechanics of fracturing and conditions for reactivation of pre-existing discontinuities. Common types of finite strain ellipsoids. L-, L-S-, and S-tectonic fabrics. Techniques of strain analysis. Particle paths and flow patterns. Progressive strain history. Introduction to deformation mechanisms. Role of fluids in deformation processes. Geometry and analyses of brittle-ductile and ductile shear zones. Sheath folds. Geometry and mechanics of development of folds, boudins, foliations and lineations. Interference patterns of superposed fold. Fault-related folding. Gravity induced structures. Tectonic features of extensional-, compressional-, and strike-slip-terrains and relevance to plate boundaries. mantle plumes.
Himalayan Orogeny; concept of super continent, their assembly and breakup.

3) PALEONTOLOGY AND ITS APPLICATIONS:

Theories on origin of life. Organic evolution – Punctuated Equilibrium and Phyletic Gradualism models. Mass extinctions and their causes. Application of fossils in age determination and correlation. Paleoecology, Life habitats and various ecosystems, Paleobiogeography. Modes of preservation of fossils and taphonomic considerations. Types of microfossils. Environmental significance of fossils and trace fossils. Use of microfossils in interpretation of sea floor tectonism. Application of micropaleontology in hydrocarbon exploration. Oxygen and Carbon isotope studies of microfossils and their use in paleoceanographic and paleoclimatic interpretation. Important invertebrate fossils, vertebrate fossils, plant fossils and microfossils in Indian stratigraphy.

4) SEDIMENTOLOGY AND STRATIGRAPHY:

Classification of sediments and sedimentary rocks ; elastic, volcanoclastic and chemical. Classification of elastic rocks. Flow regimes and processes of sediment transport. Sedimentary textures and structures. Sedimentary facies and environments, reconstruction of paleoenvironments. Formation and evolution of sedimentary basins. Diagenesis of siliciclastic and carbonate rocks.

Recent developments in stratigraphic classification. Code of stratigraphic nomenclature – Stratotypes, Global Boundary Stratotype Sections and Points (GSSP). Lithostratigraphic, chronostratigraphic and biostratigraphic subdivisions. Methods of startigraphic correlation including Shaw's Graphic correlation. Concept of sequence stratigraphy. Rates of sediment accumulation, unconformities. Facies concept in Stratigraphy – Walther's law. Methods for paleogeographic reconstruction. Earth's Climatic History. Phanerozoic stratigraphy of India with reference to the type areas– their correlation with equivalent formations in other regions. Boundary problems in Indian Phanerozoic stratigraphy.

5) MARINE GEOLOGY AND PALEOCEANOGRAPHY:

Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. hydrothermal vents-. Ocean margins and their significance. Ocean Circulation, Coriolis effect and Ekman spiral, convergence, divergence and upwelling, El Nino. Indian Ocean Dipole Thermohaline circulation and oceanic conveyor belt. Formation of Bottom waters; major water masses of the world's oceans. Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments; geochronology of oceanic sediments, diagenetic changes in oxic and anoxic environments. Tectonic evolution of the ocean basins. Mineral resources. Paleoceanography – Approaches to paleoceanographic reconstructions; various proxy indicators for paleoceanographic interpretation. Reconstruction of monsoon variability by using marine proxy records Opening and closing of ocean gateways and their effect on circulation and climate during the Cenozoic. Sea level processes and Sea level changes.

Methods of paleo Sea Surface temperature. Quantifications.

6) GEOCHEMISTRY:

Atomic Structure and properties of elements, the Periodic Table; ionic substitution in minerals; Phase rule and its applications in petrology, thermodynamics of reactions involving pure phases, ideal and non-ideal solutions, and fluids; equilibrium and distribution coefficients. Nucleation and

diffusion processes in igneous, metamorphic and sedimentary environments, redox reactions and Eh-pH diagrams and their applications. Mineral/mineral assemblages as 'sensors' of ambient environments. Geochemical studies of aerosols, surface-, marine-, and ground waters. Radioactive decay schemes and their application to geochronology and petrogenesis. Stable isotopes and their application to earth system processes; geochemical differentiation of the earth; geochemical cycles.

7) ECONOMIC GEOLOGY:

Magmatic, hydrothermal and surface processes of ore formation. Metallogeny and its relation to crustal evolution; Active ore-forming systems, methods of mineral deposit studies including ore microscopy, fluid inclusions and isotopic systematics; ores and metamorphism- cause and effect relationships. Geological setting, characteristics, and genesis of ferrous, base and noble metals. Origin, migration and entrapment of petroleum; properties of source and reservoir rocks; structural, stratigraphic and combination traps. Methods of petroleum exploration. Concepts of petrophysics, Petroliferous basins of India. Origin of peat, lignite, bitumen and anthracite. Classification, rank and grading of coal; coal petrography, coal resources of India. Gas hydrates and coal bed methane. Nuclear and non-conventional energy resources.

8) PRECAMBRIAN GEOLOGY AND CRUSTAL EVOLUTION:

Evolution of lithosphere, hydrosphere, atmosphere, biosphere, and cryosphere;, lithological, geochemical and stratigraphic characteristics of granite – greenstone and granulite belts. Stratigraphy and geochronology of the cratonic nuclei, mobile belts and Proterozoic sedimentary basins of India. Life in Precambrian. Precambrian – Cambrian boundary with special reference to India.

9) QUATERNARY GEOLOGY:

Definition of Quaternary. Quaternary Stratigraphy – Oxygen Isotope stratigraphy, biostratigraphy and magnetostratigraphy. Quaternary climates – glacial-interglacial cycles, eustatic changes, proxy indicators of paleoenvironmental/ paleoclimatic changes, - land, ocean and cryosphere (ice core studies). Responses of geomorphic systems to climate, sea level and tectonics on variable time scales in the Quaternary, Quaternary dating methods, –radiocarbon, Uranium series, Luminescence, Amino-acid. Quaternary stratigraphy of India– continental records (fluvial, glacial, aeolian, palaeosols and duricrust); marine records; continental-marine correlation of Quaternary record.
Evolution of man and Stone Age cultures. Plant and animal life in relation to glacial and interglacial cycles during Quaternary.

Tectonic geomorphology, neotectonics, active tectonics and their applications to natural hazard assessment.

10) (I)APPLIED GEOLOGY:

(i) Remote Sensing and GIS: Elements of photogrammetry, elements of photo-interpretation, electromagnetic spectrum, emission range, film and imagery, sensors, geological interpretations of air photos and imageries. Global positioning systems. GIS- data structure, attribute data, thematic layers and query analysis.

(ii) Engineering Geology: Engineering properties of rocks and physical characteristics of building stones, concretes and other aggregates. Geological investigations for construction of dams, bridges, highways and tunnels. Remedial measures. Mass movements with special emphasis on landslides and causes of hillslope instability. Seismic design of buildings.

(iii) Mineral Exploration: Geological, geophysical, geochemical and geobotanical methods of surface and sub-surface exploration on different scales. Sampling, assaying and evaluation of mineral deposits.

(iv) Hydrogeology: Groundwater, Darcy's law, hydrological characteristics of aquifers, hydrological cycle. Precipitation, evapotranspiration and infiltration processes. Hydrological classification of water-bearing formations. Fresh and salt-water relationships in coastal and inland areas. Groundwater exploration and water pollution. Groundwater regimes in India.

(II) PHYSICAL GEOGRAPHY

1) Geomorphology: Concepts in geomorphology. Historical and process Geomorphology. Landforms in relation to climate, rock type, structure and tectonics. Processes – weathering, pedogenesis, mass movement, erosion, transportation and deposition. Geomorphic processes and landforms – fluvial, glacial, eolian, coastal and karst. River forms and processes – stream flow, stage-discharge relationship; hydrographs and flood frequency analysis. Submarine relief. Geomorphology and topographic analysis including DEM, Environmental change– causes, effects on processes and landforms. Extra-terrestrial geomorphology.

2) Climatology: Fundamental principles of climatology. Earth's radiation balance; latitudinal and seasonal variation of insolation, temperature, pressure, wind belts, humidity, cloud formation and precipitation, water balance. Air masses, monsoon, Jet streams, tropical cyclones, and ENSO. Classification of climates – Koppen's and Thornthwaite's scheme of classification. Climate change.

3) Bio-geography: Elements of biogeography with special reference to India; environment, habitat, plant-animal association; zoo-geography of India; Biomes, elements of plant geography, distribution of forests and major plant communities. Distribution of major animal communities. Conservation of forests. Wildlife sanctuaries and parks.

4) Environmental Geography: Man-land relationship. Resources – renewable and non-renewable. Natural and man-made hazards – droughts, floods, cyclones, earthquakes, landslides, tsunamis. Ecological balance, environmental pollution and deterioration.

5) Geography of India: Physiography, drainage, climate, soils and natural resources – the Himalaya, Ganga-Brahmaputra Plains, and peninsular India Precambrian shield, the Gondwana rift basins, Deccan Plateau. Indian climatology with special reference to seasonal distribution and variation of temperature, humidity, wind and precipitation; Climate zones of India. Agricultural geography of India. Population – its distribution and characteristics. Urbanization and migration. Environmental problems and issues.

(III) GEOPHYSICS

1) Signal Processing: Continuous and discrete signals; Fourier series; auto and cross correlations, linear time invariant systems with deterministic and random inputs; band limited signal and sampling theorem; Fourier and Fast Fourier transforms; Z-transform; convolution; Filters: discrete and continuous, recursive, non-recursive, optimal and inverse filters; deconvolution; fractal analysis.

2) Field theory: Newtonian potential; Laplace and Poisson's equations; Green's Theorem; Gauss' law; Continuation integral; equivalent stratum; Maxwell's equations and electromagnetic theory; Displacement potential, Helmhotz's theorem and seismic wave propagation.

3) Numerical analysis and inversion: Numerical differentiation and integration, finite element, and finite difference techniques; Simpson's rules; Gauss' quadrature formula; initial value problems; pattern recognition in Geophysics. Well posed and ill-posed problems; method of least squares; direct search and gradient methods; generalized inversion techniques; singular value decomposition; global optimization.

4) Gravity and Magnetic fields of the earth: Normal gravity field; Clairaut's theorem; Shape of the earth; deflection of the vertical, geoid, free-air, Bouguer and isostatic anomalies, isostatic models for local and regional compensation. Geomagnetic field, secular and transient variations and their theories; palaeomagnetism, construction of polar wandering curves.

5) Plate Tectonics and Geodynamics: Marine magnetic anomalies, sea floor spreading; mid-oceanic ridges and geodynamics; plate tectonics hypothesis; plate boundaries and seismicity. Heat flow mechanisms, thermal moddling of earth,core-mantle convection and mantle plumes.

6)Seismology Elastic theory: Seismometry: short period, long period, broad band and strong motion; elements of earthquake seismology; seismic sources: faulting source, double couple hypothesis, seismic moment tensor, focal mechanism and fault plane solutions; seismic gaps; seismotectonics and structure of the earth; Himalayan and stable continental region earthquakes, reservoir induced seismicity; seismic hazards; earthquake prediction, travel time residuals, velocity anomalies, seismic tomography.

7) Gravity and Magnetic Methods: Gravimeters and magnetometers; data acquisition from land, air and ship; corrections and reduction of anomalies; ambiguity; regional and residual separation; continuation and derivative calculations; interpretation of anomalies of simple geometric bodies, single pole, sphere, horizontal cylinder, sheet, dyke and fault. Forward modelling and inversion of arbitrary shaped bodies and 2-D, 3-D interfaces. Interpretations in frequency domain.

8) Electrical and Electromagnetic Methods: Electrical profiling and sounding, typical sounding curves, pseudo-sections; resistivity transform and direct interpretation; induced polarization methods. Electromagnetic field techniques; elliptic polarization, in-phase and out of phase components, horizontal and vertical loop methods; interpretation; VLF (very low frequency); AFMAG (Audio frequency magnetic) methods; and central frequency sounding; transient electromagnetic methods; magneto-telluric method; geomagnetic depth sounding.

9) Seismic Methods: Generalized Snell's Law; Ray theory; reflection, refraction, diffraction; Zoeppritz's equation; seismic energy sources; detectors; seismic noises and noise profile analysis; seismic data recording, reduction to a datum and weathering corrections; Interpretation of refraction

and reflection data; CDP/CMP; velocity analysis, F-K filtering, stacking, deconvolution, migration before and after stack; bright spot analysis; wavelet processing; attenuation studies, shear waves, AVO; VSP; introduction to 3D seismics; seismic stratigraphy.

10) Well logging: Open hole, cased hole and production logging; Electrical logs; lateral, latero, induction, temperature, S.P; porosity logs; sonic, density, neutron; natural gamma; determination of formation factor, porosity, permeability, density, water saturation, lithology; logging while drilling.

(IV) METEOROLOGY

1) Climatology: Same as under Geography

2) Physical Meteorology: Thermal structure of the atmosphere and its composition. Radiation: basic Laws - Rayleigh and Mie scattering, multiple scattering, radiation from the sun, solar constant, effect of clouds, surface and planetary albedo. Emission and absorption of terrestrial radiation, radiation windows, radiative transfer, Greenhouse effect, net radiation budget; Thermodynamics of dry and moist air: specific gas constant, Adiabatic and isoentropic processes, entropy and enthalpy, Moisture variables, virtual temperature; Clausius – Clapeyron equation, adiabatic process of moist air; thermodynamic diagrams: Hydrostatic equilibrium: Hydrostatic equation, variation of pressure with height, geopotential, standard atmosphere, altimetry. Vertical stability of the atmosphere: Dry and moist air parcel and slice methods. Tropical convection. Atmospheric optics - visibility - optical phenomenon - rainbows, haloes, corona, glarg, mirage.

3) Atmospheric Electricity: Fair weather electric field in the atmosphere and potential gradients, ionization in the atmosphere. Electrical fields in thunderstorms, theories of thunderstorm electrification - Structure of lightening flash-mechanism of earth-atmospheric change balance-role of thunderstroms.

4) Cloud Physics: Cloud classification, condensation nuclei, growth of cloud drops and ice-crystals, precipitation mechanisms: Bergeron, Findeisen process, coalescence process – Precipitation of warm and mixed clouds, artificial precipitation, hail suppression, fog and cloud – dissipation, radar observation of clouds and precipitation, radar equation, rain drop spectra, radar echoes of hail storm and tornadoes, radar observation of hurricanes, measurements of rainfall by radar.

5) Dynamic Meteorology: Basic equations and fundamental forces: Pressure, gravity, centripetal and Corolis forces, continuity equation in Cartesian and isobaric coordinates. Momentum equation Cartesian and spherical coordinates; scale analysis, inertial flow, geostrophic and gradient winds, thermal wind. Divergence and vertical motion Rossby, Richardson, Reynolds and Froude numbers. Circulation, vorticity and divergence; Bjerknese circulation theorem and applications, vorticity and divergence equations, scale analysis, potential vorticity, stream function and velocity potential. Atmospheric turbulence: Mixing length theory, planetary boundary layer equations, surface layer, Ekman layer, eddy transport of heat, moisture and momentum, Richardson criterion; Linear Perturbation Theory: Internal and external gravity waves, inertia waves, gravity waves, Rossby waves, wave motion in the tropics, barotropic and baroclinic instabilities. Atmospheric Energetics: Kinetic, potential and internal energies – conversion of potential and internal energies into kinetic energy, available potential energy.

6) Numerical Weather Prediction: computational instability, filtering of sound and gravity waves, filtered forecast equations, barotropic and equivalent barotropic models, two parameter baroclinic model, relaxation method. Multi-layer primitive equation models. Short, medium and long range weather prediction. Objective analysis; Initialization of the data for use in weather prediction models; data assimilation techniques, application of satellite in NWP (Numerical Weather Prediction) and remotely sensed data.

7) General Circulation and Climate Modelling: Observed zonally symmetric circulations, meridional circulation models, mean meridional and eddy transport of momentum and energy, angular momentum and energy budgets; zonally asymmetric features of general circulation; standing eddies; east-west circulations in tropics: climate variability and forcings; feedback processes, low frequency variability, MJO Madden-Julian oscillation), ENSO, QBO (quasi-biennial oscillation) and sunspot cycles. Basic principles of general circulation modelling; grid-point and spectral GCMs; role of the ocean in climate modelling; interannual variability of ocean fields (SST, winds, circulation, etc.) and its relationship with monsoon, concepts of ocean – atmosphere coupled models.

8) Synoptic Meteorology: Weather observations and transmission, synoptic charts, analysis of surface, upper air another derivative chart, stream-lines, isotachs and contour analysis; tilt and slope of pressure/weather systems with height. Synoptic weather forecasting, prediction of weather elements such as rain, maximum and minimum temperature and fog; hazardous weather elements like thunderstorms, duststorms, tornadoes. Tropical meteorology: Trade wind inversion, ITCZ; monsoon trough tropical cyclones, their structure and development theory; monsoon depressions; tropical easterly jet stream; low level jets, Somali jet, waves in easterlies; western disturbances; SW and NE monsoons; synoptic features associated with onset, withdrawal, break active and weak monsoons and their prediction. Air masses and fronts: sources, origin and classification of air masses; and fronts, frontogenesis and frontolysis; structure of cold and warm fronts; weather systems associated with fronts. Extra-tropical synoptic scale features: jet streams, extratropical cyclones and anticyclones.

9) Aviation Meteorology: Role of meteorology in aviation, weather hazards associated with take off cruising and landing, inflight – icing, turbulence, visibility, fog, clouds, rain, gusts, wind shear and thunderstorms, nowcasting and very short range forecasting.

10) Satellite Meteorology: Meteorological satellites – Polar orbiting and geostationary satellites, visible and infrared radiometers, multiscanner radiometers; identification of synoptic systems, fog and sandstorms, detection of cyclones, estimation of SST, cloud top temperatures, winds and rainfall: temperature and humidity soundings.

(V) OCEAN SCIENCES

1) Physical Oceanography: T-S diagrams; mixing processes in the oceans; characteristics of important water masses.
Wind generated waves in the oceans; their characteristics; shallow and deep water waves. Propagation, refraction, and reflection of waves. Wave spectrum, principles of wave forecasting.

Tide-producing forces and their magnitudes; prediction of tides by the harmonic method; tides and tidal currents in shallow seas, estuaries and rivers. Factors influencing coastal processes; transformation of waves in shallow water; effects of stratification; effect of bottom friction,

phenomena of wave reflection, refraction and diffraction; breakers and surf; littoral currents; wave action on sediments – movement to beach material; rip currents; beach stability, ocean beach nourishment; harbour resonance; seiches; tsunami; interaction of waves and structure.
Estuaries: classification and nomenclature; tides in estuaries; estuarine circulation and mixing; depth – averaged and breadth – averaged models; sedimentation in estuaries; salinity intrusion in estuaries; effect of stratification; coastal pollution; mixing and dispersal of pollutants in estuaries and near-shore areas; coastal zone management.
The global wind system; action of wind on ocean surface; Ekman's theory; Sverdrup, Stommel and Munk's theories; upwelling and sinking with special reference to the Indian ocean. Inertial currents; divergences and convergences; geostrophic motion; barotropic and baroclinic conditions; oceanic eddies, relationship between density, pressure and dynamic topography; relative and slope currents. Wind driven coastal currents; typical scales of motion in the ocean.
Characteristics of the global conveyor belt circulation and its causes.
Formation of subtropical gyres; western boundary currents; equatorial current systems; El Nino; monsoonal winds and currents over the North Indian Ocean; Somali current; southern ocean. Upwelling process in the Arabian Sea.

2) Chemical Oceanography: Composition of seawater – Classification of elements based on their distribution; major and minor elements, their behavior and chemical exchanges across interfaces and residence times in seawater.

Element chemistry in atypical conditions-estuaries, hydrothermal vents, anoxic basins, HNLC waters, sediment pore fluid and anthropogenic inputs.

Chemical and biological interactions – Ionic interactions; biochemical cycling of nutrients, trace metals and organic matter. Air-sea exchange of important biogenic dissolved gases; carbon dioxide-carbonate system; alkalinity and control of pH; biological pump.

Factors affecting sedimentary deposits-$CaCO_3$, Silicate, Manganese nodules, phosphorites and massive single deposits.

3) Geological Oceanography: Same topics as under subhead "Marine Geology & paleo-oceanography"

4) Biological Oceanography: Classification of the marine environment and marine organisms.

Physio-chemical factors affecting marine life – light, temperature, salinity, pressure, nutrients, dissolved gases; adaptation and biological processes.

Primary and secondary production; factors controlling phytoplankton and zooplankton abundance and diversity; nekton and fisheries oceanography; benthic organisms; coastal marine communities and community ecology – estuaries, coral reefs and mangrove communities, deep-sea ecology including hydrothermal vent communities.

Energy flow and mineral cycling – energy transfer and transfer efficiencies through different trophic levels; food webs including the microbial loop.

Human impacts on marine communities; impacts of climate change on marine biodiversity.
Impact of pollution on marine environments including fisheries.

हिन्दी
07

विश्वविद्यालय अनुदान आयोग
नेट-ब्यूरो

Code No. 20

विषय - हिन्दी

पाठ्यक्रम

इकाई - I

हिन्दी भाषा और उसका विकास।

हिन्दी की ऐतिहासिक पृष्ठभूमि : प्राचीन भारतीय आर्य भाषाएं, मध्यकालीन भारतीय आर्य भाषाएं– पालि, प्राकृत – शौरसेनी, अर्द्धमागधी, मागधी, अपभ्रंश और उनकी विशेषताएं, अपभ्रंश अवहठ, और पुरानी हिन्दी का संबंध, आधुनिक भारतीय आर्य भाषाएं और उनका वर्गीकरण। हिन्दी का भौगोलिक विस्तार : हिन्दी की उपभाषाएं, पश्चिमी हिन्दी, पूर्वी हिन्दी, राजस्थानी, बिहारी तथा पहाड़ी वर्ग और उनकी बोलियां। खड़ीबोली, ब्रज और अवधी की विशेषताएं। हिन्दी के विविध रूप : हिन्दी, उर्दू, दक्खिनी, हिन्दुस्तानी। हिन्दी का भाषिक स्वरूप : हिन्दी की स्वनिम व्यवस्था – खंड्य और खंड्येतर, हिन्दी ध्वनियों के वर्गीकरण का आधार, हिन्दी शब्द रचना –उपसर्ग, प्रत्यय, समास, हिन्दी की रूप रचना – लिंग, वचन और कारक व्यवस्था के सन्दर्भ में संज्ञा, सर्वनाम, विशेषण और क्रिया रुप, हिन्दी – वाक्य – रचना। हिन्दी भाषा – प्रयोग के विविध रूप : बोली, मानक भाषा, राजभाषा, राष्ट्रभाषा और सम्पर्क भाषा। संचार माध्यम और हिन्दी, कम्पूटर और हिन्दी, हिन्दी की संवैधानिक स्थिति। देवानागरी लिपि : विशेषताएं और मानकीकरण।

06

इकाई – II

हिन्दी साहित्य का इतिहास

हिन्दी साहित्येतिहास दर्शन

हिन्दी साहित्य के इतिहास लेखन की पद्धतियां

हिन्दी साहित्य का कालविभाजन और नामकरण, आदिकाल की विशेषताएं एवं साहित्यिक प्रवृतियां, रासो-साहित्य, आदिकालीन हिन्दी का जैन साहित्य, सिद्ध और नाथ साहित्य, अमीर खुसरो की हिन्दी कविता, विद्यापति और उनकी पदावली तथा लौकिक साहित्य

भक्तिकाल

भक्ति-आंदोलन के उदय के सामाजिक-सांस्कृतिक कारण, भक्ति-आंदोलन का अखिल भारतीय स्वरुप और उसका अन्त:प्रादेशिक वैशिष्ट्य।

भक्ति काव्य की सामाजिक-सांस्कृतिक पृष्ठभूमि, आलवार सन्त। भक्ति काव्य के प्रमुख सम्प्रदाय और उनका वैचारिक आधार। निर्गुण-सुगण कवि और उनका काव्य।

रीतिकाल

सामाजिक-सांस्कृतिक पृष्टभूमि, रीतिकाल की प्रमुख प्रवृत्तियां (रीतिबद्ध, रीतिसिद्ध, रीतिमुक्त) रीतिकवियों का आचार्यत्व।

रीतिकाल के प्रमुख कवि और उनका काव्य

आधुनिक काल

हिन्दी गद्य का उद्भव और विकास। भारतेन्दु पूर्व हिन्दी गद्य, 1857 की क्रान्ति और सांस्कृतिक पुनर्जागरण, भारतेन्दु और उनका युग, पत्रकारिता का आरम्भ और 19वीं शताब्दी की हिन्दी पत्रकारिता, आधुनिकता की अवधारणा।

द्विवेदी युग : महावीर प्रसाद द्विवेदी और उनका युग, हिन्दी नवजागरण और सरस्वती, राष्ट्रीय काव्य धारा के प्रमुख कवि, स्वछन्दतावाद और उसके प्रमुख कवि।

छायावाद : छायावादी काव्य की प्रमुख विशेषताएं, छायावाद के प्रमुख कवि, प्रगतिवाद की अवधारणा, प्रगतिवादी काव्य और उसके प्रमुख कवि, प्रयोगवाद और नई कविता, नई कविता के कवि, समकालीन कविता (वर्ष 2000 तक) समकालीन साहित्यिक पत्रकारिता।

हिन्दी साहित्य की गद्य विधाएं

हिन्दी उपन्यास :भारतीय उपन्यास की अवधारणा।
प्रेमचन्द पूर्व उपन्यास, प्रेमचन्द और उनका युग।
प्रेमचन्द के परवर्ती उपन्यासकार (वर्ष 2000 तक)।

हिन्दी कहानी : हिन्दी कहानी का उद्भव और विकास, 20वीं सदी की हिन्दी कहानी और प्रमुख कहानी आंदोलन एवं प्रमुख कहानीकार।

हिन्दी नाटक : हिन्दी नाटक और रंगमंच, विकास के चरण, भारतेन्दुयुग, प्रसाद युग,प्रसादोत्तर युग, स्वातंत्र्योत्तर युग, साठोत्तर युग और नया नाटक
प्रमुख नाट्यकृतियाँ, प्रमुख नाटककार (वर्ष 2000 तक)।
हिन्दी एकांकी । हिन्दी रंगमंच और विकास के चरण, हिन्दी का लोक रंगमंच। नुक्कड़ नाटक ।

हिन्दी निबंध : हिन्दी निबन्ध का उद्भव और विकास, हिन्दी निबंध के प्रकार और प्रमुख निबंधकार।

हिन्दी आलोचना– हिन्दी आलोचना का उद्भव और विकास। समकालीन हिन्दी आलोचना एवं उसके विविध प्रकार। प्रमुख आलोचक।

हिन्दी की अन्य गद्य विधाएँ : रेखाचित्र, संस्मरण, यात्रा साहित्य, आत्मकथा, जीवनी और रिपोर्ताज, डायरी।

हिन्दी का प्रवासी साहित्य : अवधारणा एवं प्रमुख साहित्यकार।

इकाई – III

साहित्यशास्त्र

काव्य के लक्षण, काव्य हेतु और काव्य प्रयोजन।

प्रमुख संप्रदाय और सिद्धान्त – रस, अलंकार, रीति, ध्वनि, वक्रोक्ति और औचित्य।

रस निष्पत्ति, साधारणीकरण।

शब्दशक्ति, काव्यगुण, काव्य दोष

प्लेटो के काव्य सिद्धान्त।

अरस्तू : अनुकरण सिद्धान्त, त्रासदी विवेचन, विरेचन सिद्धान्त।

वर्ड्सवर्थ का काव्यभाषा सिद्धान्त।

कॉलरिज : कल्पना और फैंटेसी।

टी.एस.इलिएट : निर्वैयक्तिकता का सिद्धान्त, परम्परा की अवधारणा।

आई.ए.रिचर्ड्स : मूल्य सिद्धान्त, संप्रेषण सिद्धान्त तथा काव्य-भाषा सिद्धान्त। रूसी रुपवाद।

नयी समीक्षा। मिथक, फन्तासी, कल्पना, प्रतीक, बिम्ब।

इकाई – IV

वैचारिक पृष्ठभूमि

भारतीय नवजागरण और स्वाधीनता आन्दोलन की वैचारिक पृष्ठभूमि

हिन्दी नवजागरण । खड़ीबोली आन्दोलन। फोर्ट विलियम कॉलेज

भारतेन्दु और हिन्दी नवजागरण,

महावीर प्रसाद द्विवेदी और हिन्दी नवजागरण

गांधीवादी दर्शन

अम्बेडकर दर्शन

लोहिया दर्शन

मार्क्सवाद, मनोविश्लेषणवाद, अस्तित्ववाद, उत्तर आधुनिकतावाद, अस्मितामूलक विमर्श (दलित, स्त्री, आदिवासी एवं अल्पसंख्यक)

इकाई – V

हिन्दी कविता

पृथ्वीराज रासो – रेवा तट

अमीरखुसरो – खुसरों की पहेलियाँ और मुकरियाँ

विद्यापति की पदावली (संपादक – डॉ. नरेन्द्र झा) – पद संख्या 1 - 25

कबीर – (सं.- हजारी प्रसाद द्विवेदी) – पद संख्या – 160 - 209

जायसी ग्रंथावली – (सं. राम चन्द्र शुक्ल) – नागमती वियोग खण्ड

सूरदास – भ्रमरगीत सार – (सं.- राम चन्द्र शुक्ल) – पद संख्या 21 से 70

तुलसीदास – रामचरितमानस, उत्तर काण्ड

बिहारी सतसई – (सं.- जगन्नाथ दास रत्नाकर) – दोहा संख्या 1 – 50

घनानन्द कवित्त – (सं.- विश्वनाथ मिश्र) – कवित्त संख्या 1 – 30

मीरा – (सं.- विश्वनाथ त्रिपाठी) – प्रारम्भ से 20 पद

अयोध्या सिंह उपाध्याय हरिऔध – प्रियप्रवास

मैथिलीशरण गुप्त – भारत भारती, साकेत (नवम् सर्ग)

जयशंकर प्रसाद – आंसू, कामायनी (श्रद्धा, लज्जा, इड़ा)

निराला - जुही की कली, जागो फिर एक बार, सरोजस्मृति, राम की शक्तिपूजा, कुकरमुत्ता, बाँधो न नाव इस ठाँव बंधु।

सुमित्रानंदन पंत – परिवर्तन, प्रथम रश्मि

महादेवी वर्मा – बीन भी हूँ मैं तुम्हारी रागिनी भी हूँ, मै नीर भरी दुख की बदली, फिर विकल है प्राण मेरे, यह मन्दिर का दीप इसे नीरव जलने दो, द्रुत झरो जगत के जीर्ण पत्र

रामधारी सिंह दिनकर – उर्वशी (तृतीय अंक), रश्मिरथी

नागार्जुन – कालिदास, बादल को घिरते देखा है, अकाल और उसके बाद, खुरदरे पैर, शासन की बंदूक, मनुष्य हूँ।

सच्चिदानंद हीरानन्द वात्स्यायन अज्ञेय – कलगी बाजरे की, यह दीप अकेला, हरी घास पर क्षण भर, असाध्यवीणा, कितनी नावों में कितनी बार

भवानीप्रसाद मिश्र – गीत फरोश, सतपुड़ा के जगल

मुक्तिबोध – भूल गलती, ब्रह्मराक्षस, अंधेरे में

धूमिल – नक्सलवाड़ी, मोचीराम, अकाल दर्शन, रोटी और संसद

इकाई –VI

हिन्दी उपन्यास

पं. गौरीदत्त – देवरानी जेठानी की कहानी

लाला श्रीनिवास दास – परीक्षा गुरू

प्रेमचन्द – गोदान

अज्ञेय – शेखर एक जीवनी (भाग – 1)

हजारी प्रसाद द्विवेदी – बाणभट्ट की आत्मकथा

फणीश्वर नाथ रेणु – मैला आंचल

यशपाल – झूठा सच

अमृत लाल नागर – मानस का हंस

भीष्म साहनी – तमस

श्रीलाल शुक्ल – राग दरबारी

कृष्णा सोबती – जिन्दगी नामा

मन्नू भंडारी – आपका बंटी

जगदीश चन्द्र – धरती धन न अपना

इकाई –VII

हिन्दी कहानी

राजेन्द्र बाला घोष (बंग महिला) - चन्द्रदेव से मेरी बातें, दुलाईवाली

माधवराव सप्रे – एक टोकरी भर मिट्टी

सुभद्रा कुमारी चौहान – राही

प्रेमचंद – ईदगाह, दुनिया का अनमोल रतन

राजा राधिकारमण प्रसाद सिंह – कानों में कंगना

चन्द्रधर शर्मा गुलेरी – उसने कहा था

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