



CLUSTER UNIVERSITY SRINAGAR

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Syllabus for Lateral Entry Common Entrance Test for Admission to 3rd Semester in B. Tech. Engineering Programme, Cluster University Srinagar, effective from Academic Session 2019-20

1. Mathematics:

DIFFERENTIAL CALCULUS: Successive differentiation, Leibnitz theorem, Tangent & Normals. Taylor & McLaren's Theorem, Asymptotes, Double points, curvature, Curve tracing in Cartesian, polar and parametric forms. Partial differentiation with errors and approximations, Euler's theorem on homogeneous functions,

FUNCTIONS OF SEVERAL VARIABLES, LIMITS, CONTINUITY & DIFFERENTIABILITY: Taylor's and McLaren's series of two variables, Maxima and Minima of functions of two variables. Definite integrals and their properties. Line integrals, double integral and triple integrals with examples. Green theorem with examples.

ORDINARY DIFFERENTIAL EQUATIONS: Linear and Bernoulli's Differential Equations. Exact & Non exact differential equations. Higher order linear differential equations, complimentary functions and particular integral. General solutions. Non-linear first order differential equations. Clairaut's theorem.

ALGEBRAIC EQUATIONS AND COMPLEX TRIGONOMETRY: Elementary theory of polynomials. Fundamental theorem. Relation between roots and co-efficient. Transformation of equation and removal of terms. Sols of cubic and bi-quadratic equations.

Review of complex numbers. Demovier's theorem with applications. Function of complex variables. Exponential, Circular, Hyperbolic & Logarithmic functions.

SEQUENCE & SERIES: General principle of convergence. Convergence and divergence of a series, Cauchy's Integral test, p-test, comparison test, Cauchy's root test, D' Alembert Ratio Test, Raabe's Test, Gauss test, alternating series.. Leibnitz test. Absolute and conditional convergence.

LINEAR ALGEBRA: Elementary transformations: Inverse using elementary transformation, Rank of a matrix. Normal form of a matrix, Eigen values and Eigen vector, Properties of Eigen value, Cayley Hamilton Theorem, Reduction to diagonal form, Vector spaces, Linear dependence and independence of vectors, consistency of linear system of equations, linear and orthogonal transformations, Reduction of quadratic form to canonical form.

FOURIER SERIES: Introduction, Euler's formulae, sufficient conditions for a Fourier expansion, functions having points of discontinuity, change of intervals. Odd and even functions, Fourier expansion of Odd and even periodic functions, half range series, typical wave forms, Parseval's formula.

POWER SERIES SOLUTIONS OF SECOND ORDER O.D.E: Analytic function, ordinary point, singular point, regular and irregular singular points of o.d.e. $Y'' + P(x)Y' + Q(x)Y = 0$, Series solution of such differential equations about an ordinary point, Frobenius series solution about a regular singular point.

FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS:-Formation of p.d.e, First order linear p.d.e, Lagrange's method Non-Linear p.d.e. of 1st order, solution by Charpit's method, Four Standard forms of non-linear p.d.e with reference to Charpit's technique.

HIGHER ORDER LINEAR P.D.E: Homogenous and Non-homogenous higher order linear partial differential with constant coefficient inverse operator $1/f(D,D')$, Rules for finding P.I and C.F, Non-Linear equations of 2nd order. Application of p.d.e, method of separation of variables to solve equations of vibrations of strings (or one dim wave equation), one dim and two dim heat flow equations, Laplace equations, transmission line).

2. Physics:

ELECTROSTATICS: Review of Vector Algebra, Scalar and Vector fields, Gradient of a Scalar field, Divergence and curl of a vector field and their physical significance, solenoidal fields, Gauss Divergence theorem, Stokes theorem and their applications, Vector Identities Gauss's law in vector notation (differential and integral forms), Applications of Gauss's law to find electric fields due to a long straight charged wire, Cylindrical and Spherical charge distributions.

MAGNETOSTATICS: Derivation of Ampere's Circuital law, Application of Ampere's circuital law to find magnetic intensity due to long cylindrical wire, due to a long solenoid. Differential & Integral form of Faraday's law of electromagnetic induction, Equation of continuity, Displacement current and its significance, Maxwell's field equations (differential and integral forms), Betaron,

Electromagnetic wave propagation in free space (e.m wave equations for \vec{E} & \vec{B}) fields for free space and their solutions (plane wave solution), velocity of e.m. waves, Relation between E_0 & B_0 . Definition of Poynting Vector, Poynting theorem.

APPLIED OPTICS: Interference in thin films (by reflection and transmission of light), Theory of Newton's rings by reflected light, Determination of wave length and refractive index of monochromatic light by Newton's theory.

Fraunhofer & Fresnel's diffractions Fresnel's half period zones and rectilinear propagation of light, Fraunhofer diffraction due to a single slit, plane diffraction grating & its theory for secondary maxima and minima.

Unpolarized and polarized light, Nicol Prism, Mathematical representation of polarization of different types, Quarter & half wave plates.

OSCILLATIONS AND FIBRE OPTICS: Free damped and forced oscillations and their differential equations, Logarithmic decrement, power dissipation & Quality factor, ultrasonic waves and their production by Piezoelectric method and applications (General)

Propagation of light in fibres, numerical aperture, Single mode and multimode fibres, General applications

RELATIVISTIC DYNAMICS: Concept of Relativity, Frames of reference, Galilean Transformations, Michelson and Morley's experiment, Postulates of Special Theory of relativity, Lorentz transformations, Length Contraction, Time dilation, variation of mass with velocity (Velocity addition), mass energy equivalence ($E^2 = P^2 c^2 + m_0^2 c^4$).

WAVE-PARTICLE DUALITY: Black Body radiation spectrum (Characteristics & Energy distribution), Wien's laws, Rayleigh Jeans Law excluding mathematical derivations, ultraviolet Catastrophe, Planck's hypothesis and Planck's radiation law, Explanation of black body radiation characteristics on the basis of Planck's law, photon concept.

Compton effect, derivation of the direction of emission and the change in wavelength of scattered photons, direction of recoil electron and discussion of observed results.

Debroglie's hypothesis, concept of matter waves, Davisson & Germer's experiment, wavepacket, Phase and Group velocity, Heisenberg's uncertainty principle. Experimental illustration of uncertainty principle using single slit.

QUANTUM MECHANICS: Wave function definition, interpretation and significance of wave function, Schrodinger's wave equations (Steady-State and time dependent) for 1-dim case, concept of operators and expectation values, Applications of Schrodinger's equation (Time independent) to a) Particle in a 1-dimensional box of infinite height, b) single step potential barrier, c) Tunnel effect, d) Quantum Mechanical harmonic oscillator with concept of Zero point energy.

SOLID STATE PHYSICS AND LASERS: Intrinsic & extrinsic semi-conductors, Fermi & impurity levels, Impurity compensation, charge neutrality equation and semi-conductor conductivity. Einstein's relation, drift and diffusion current. Introductory concepts of advanced materials viz; conducting polymers dielectric materials, Nanomaterials, Smart materials and High T_c materials.

Lasers: Principle of Laser action, population Inversion, Einstein's Coefficients, He-Ne & Ruby Lasers, Holography

3. Chemistry:

SPECTROSCOPY: UV Spectroscopy –Electronic transitions, spectrum, shift of bands with solvents for double bonds, carbonyl compounds and aromatic compounds.

IR-Spectroscopy –Introduction, brief idea about instrumentation, applications and interpretation of IR Spectra, characterization of functional groups and frequency shift associated with structural changes.

¹H-NMR Spectroscopy –Theory of ¹H-NMR Spectroscopy, equivalent and non-equivalent protons, chemical shift, spin-spin coupling, spin-spin splitting, ¹H'-NMR spectrum of a few organic compounds.

COORDINATION & ORGANOMETALLIC COMPOUNDS: Complex formation and Stability Constants, Factors affecting stability of complexes, Bonding in coordination compounds (Werner's, VBT, CFT), Explanation to Magnetic & Spectral Properties.

Introduction to Organometallic compounds, 18 & 16-electron rules. Application of organometallic compounds.

ELECTROCHEMISTRY: Reduction potential, Redox stability in water, the diagrammatic presentation of potential data, the effect of complex formation on potentials, Electrolytes & Non-electrolytes, Kind of electrodes, Electrochemical & electrolytic cells, Faradays Laws of electrolysis, Batteries.

LUBRICANTS, DYES & DRUGS: Definition & functions of lubricants, mechanism of lubrication, classification of lubricants (Lubricating oils, semi-solid lubricants and solid lubricants) synthetic lubricants, flash and fire points, oiliness, Cloud and Aniline points.

Classification of dyes and drugs. Application of following class of drugs:

- a) Narcotics b) Tranquilizers c) Antipyretics d) Antibiotics

ENVIRONMENTAL CHEMISTRY AND WATER TREATMENT: Concept of Environmental chemistry, segments of environment (a brief idea about atmosphere,

hydrosphere and lithosphere). Air Pollution– Introduction, Types of air pollution and control of air pollution. Water Pollution: Introduction, Sources of water pollution and methods of controlling water pollution. Chemicals and Metal Toxicology-(biochemical effects of Pb, Hg, As, Zn, Cd, Ni, Se, O₃ and pesticides in brief on man).

Water Treatment: Introduction, Types of water, softening of water by different processes, chemical methods and sterilization, priming and foaming, sludge and scale formation, determination of hardness of water by soap titration method and EDTA method. Numericals based on hardness and softening of water.

INORGANIC CEMENTING MATERIALS: Cement and Lime – Introduction, classification of lime, manufacture and properties of lime, Cement, types of cement, manufacture of Portland cement, setting and hardening of cement.

POLYMER CHEMISTRY AND RUBBER: Introduction, Classification of polymers, Mechanism of polymerization (Addition & Condensation polymerization).Plastics, moulding constituents of a plastic, moulding of plastics into articles (compression moulding, injection moulding, transfer moulding and extrusion moulding). Preparation, properties and uses of following plastic materials:

- a) Polymethyl methacrylate
- b) Epoxy resins
- c) Alkyd resins.

Rubber: Introduction, Types of rubber & its vulcanization. Preparation, Properties & uses of Synthetic Rubber, Buna-S, Buna-N.

BIOMOLECULES: Carbohydrates & their importance, Amino acids, Proteins, Types & Structures of proteins, denaturation of proteins. Enzymes & Kinetics of enzyme action. Lipids & its various types, role of Lipids. Vitamins, kinds of vitamins & the diseases caused by their deficiency. Hormones & their role in living systems. Coordination sites in biomolecules.