

ANNEXURE – I

SYLLABI FOR THE ENTRANCE TEST

PART – III (Group C) – Examination Centre only at Chennai

1. PHYSICS - (The examination for this Subject will be held at Chennai only)

Thermodynamics and Statistical Mechanics:

Laws of thermodynamics – Enthalpy, Entropy, and different heats – Maxwell's thermodynamic relations – Chemical potential – Phase transitions: First and second order, and critical phenomena – Liouville's theorem, equi partition theorem, and Partition function – Ensembles: Micro-canonical, Canonical, and Grand canonical, Statistics: Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac.

Electricity and Magnetism : Coulomb's law and superposition– Gauss's law – Applications - electrostatic potential – Poisson's and Laplace's equations - Kirchoff's law – thermo electric effects – (Seebeck, Peltier, Thomson) - applications. Maxwell's equations and electromagnetic wave propagation
Magnetism: - magnetic effects of current – motion of charged particles in magnetic field – Biot–Savart law, Ampere's law (differential form) – Hall effect – electromagnetic induction –Faraday's law – Lenz's law – eddy current – Inductance – mutual and self inductance – transformer.

Modern physics : Emission and absorption of radiation: spontaneous and stimulated processes – Planck's law - thermionic emission – photoelectric effect – Compton scattering - atomic spectra - atom models – molecular spectra – dual nature of matter and radiation – de Broglie hypothesis – Uncertainty principle – Zeeman and Stark effects – spin-orbit coupling - nuclear structure – properties – natural radioactivity – decay law - nuclear stability - nuclear reactions – fission – fusion – fundamental particles – high energy physics.

Solid State Physics and Electronics : Crystal systems – Bravais lattices - Types of bonding in solids - Classical free electron theory – density of states- electron in a periodic potential – Bloch Theorem - Kronig-Penney model - Brillouin Zones - Quantum state and degeneracy - origin of energy band gap - electrical conductivity – thermal conductivity – Wiedemann-Franz law

Direct and indirect band gap semiconductors – intrinsic – extrinsic – carrier concentration, mobility, drift and diffusion currents - PN junction – diode characteristics – Zenar diode – LED, laser diode – Photodiode – Transistor – action and characteristics – amplifier – oscillator – basic logic gates.

Dielectric and magnetic materials: Different types of polarization – Internal field – Clausius- Mosotti equation- dielectric breakdown- applications of dielectric materials – Ferroelectricity - Magnetization and magnetic susceptibility - Different types of magnetic materials: diamagnetism – paramagnetism – ferromagnetism – domain theory of ferromagnetism – hysteresis - hard and soft magnetic materials- exchange interaction - applications of magnetic materials.

Superconducting materials: General properties of superconducting materials – Meissner effect – penetration depth, coherence length - types of superconductors – mixed state and vortex dynamics, flux pinning - BCS theory: Cooper pair formation, High- T_c superconductors and their applications.

Nanomaterials: Size effects, surface-to-volume ratio - Quantum wells, wires, dots – quantum confinement effects (optical, electrical, magnetic, mechanical, and catalytic properties)- Preparation methods: Top down and bottom-up approaches - applications – Carbon nanotubes - chirality and electronic properties (metallic vs semiconducting).