

PHYSICS (CODE NO. 06)

PAPER - I

1. Mechanics and Relativity

Conservative force field and potential energy, Gravitational potential, Motion under central force , Kepler's Law, Centre of mass and laboratory coordinate system. Coriolis force and its application's, Conservation of linear and angular momentum, Inertial and non inertial Frams, Michelson - Morley experiment and its implications. Galilian transformation, Lorentz transformation, length contraction, time dilation, velocity addition theorem. Variation of mass with velocity, mass energy equivalence, particle with zero rest mass.

2. Thermal & Statistical Physics

Maxwell's relations and their applications. Cooling by Adiabatic demagnetization. Einstein & Debye theory of specific heat of solids, concept of phonons. Statistical basis of thermodynamics, constrains, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states. Probability and entropy, Boltzmann entropy relation, Mexwellian Distribution of Speeds and velocities .Doppler's broadening of spectral lines.

3. Optics

Michelson interferometer. Fabry perot interferometer Holography and its simple applications. Diffraction grating , Concave grating and its different mountings. Double refraction, optical rotation and rotation of plane of polarization.

4. Electricity and Electronics

AC circuits, complex numbers and their applications in solving AC circuit problems. Transmission of electric power , Magnetic force on moving Charge , Biot Sevart law, Ampears Law, Theory of diodes, Types of diodes and their applications. Characteristics of transistors, h parameters, bias stability, thermal runaway. FET: JFET and MOSFET, their construction, working and uses.

5. Sound and Acoustics

Speed of transverse waves in a uniform string. Speed of longitudinal waves in a fluid. Energy density and energy transmission in waves. Diffraction of sound. Principle of sonar system, ranging. Noise and music, intensity and loudness and their units, transducers and their characteristics. Recording and reproduction of sound. Acoustics of halls, reverberation period, Sabine formula.

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PAPER - II

1. Quantum Mechanics

De-Broglies Hypothesis, Heisenberg uncertainty relation for p and x , its extension to energy and time, consequences of uncertainty relation., gamma ray microscope, particle in a box.

Schrodinger's equation, postulatory basis of quantum mechanics, operators, expectation values, transition probabilities, application to a particle in one and three dimensional boxes, harmonic oscillator.

2. Atomic Spectra

Hydrogen atom, natural occurrence of n , l and m quantum numbers, the related physical quantities, comparison with Bohr's theory.

Spectra of hydrogen, deuteron and alkali atoms, spectral terms, doublet fine structure, screening constants for alkali spectra for s , p , d and f states, selection rules, singlet and triplet fine structure in alkaline earth spectra, L-S coupling and J-J coupling, fine structure of hydrogen atom.

3. Molecular Spectra and Spectroscopy

Discrete set of electronic energies of molecules, quantization of vibrational and rotational energies, determination of inter nuclear distance, pure rotational and rotation - vibration spectra. Dissociation limits for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect. Stokes and antistokes lines, complementary character of

Raman and infrared spectra, experimental arrangement for Raman spectroscopy. Fluorescence & phosphorescence.

4. Solid State Physics

Lattices : Lattice types, lattice planes. Common crystal structures Laue's theory of X-ray diffraction, Bragg's Law, electrons in periodic potential; nearly free electron model (qualitative), energy bands, energy gap, metals, semiconductors, insulators, density of states, Fermi energy, Fermi velocity.

Mobility of electrons and holes, Hall effect and Hall coefficient.

5. Nuclear Physics

Basic nuclear properties, general concepts of nuclear forces, working of nuclear detectors, G-M counter, proportional and scintillation counters, cloud chamber, spark chambers. Nuclear reactions, Q-value of nuclear reactions, nuclear fission and nuclear fusion (concepts), energy production in stars. Compound nucleus, direct reactions (concepts). Shell model, liquid drop model.