



MECHANICS AND ELECTRICITY

R CHAND & Co., NEW DELHI

SYLLABUS

Physics

Semester-I

Paper-I: Classical Mechanics and Theory of Relativity

Max. Marks: 50

Time: 3 hours

Note:

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and will be based on the conceptual aspects of the entire syllabus. This question may have 5 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks

UNIT-I

Basic Concept of Classical Mechanics: Mechanics of single and system of particles, Conservation law of linear momentum, angular momentum and mechanical energy for a particle and a system of particles and equation of motion, Constrained motion.

UNIT-II

Generalized Notations: Degrees of freedom and Generalized co-ordinates, Transformation equations, Generalized Displacement, Velocity, Acceleration, Momentum, Force and Potential, Hamilton's variational principle, Lagrange's equation of motion from Hamilton's principle, Simple Harmonic oscillator, Simple pendulum, Atwood's machine

UNIT-III

Theory of relativity: Frame of reference, limitation of Newton's law of motion, Inertial frame of reference, Galilean transformation, Frame of reference with linear acceleration, Classical relativity-Galilean invariance, Transformation equation for a frame of reference-inclined to an inertial frame and Rotating frame of reference, Non-inertial frames. The accelerated frame of reference and rotating frame of reference. Effect of centrifugal and coriolis forces due to Earth's rotation, Fundamental frame of reference, Michelson-Morley's experiment, concept of Einstein's relativity.

UNIT-IV

Applications of Theory of Relativity: Special theory of relativity, Lorentz co-ordinate and physical significance of Lorentz invariance, Length Contraction, Time Twin Paradox, Velocity addition theorem, Variation of mass with velocity, Mass energy equivalence, Transformation of relativistic momentum and energy, between relativistic momentum and energy, Mass, velocity, momentum and energy of zero rest mass.

SYLLABUS

Physics

Semester-I

Paper-II: Electricity, Magnetism and Electromagnetic Theory

Max. Marks: 50

Time: 3 hours

Note:

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and will be based on the conceptual aspects of the entire syllabus. This question may have 5 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks

UNIT-I

Vector background and Electric field: Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem. Stoke's theorem.

Derivation of electric field E from potential as gradient, Derivation of Laplace and Poisson equations, Electric flux, Gauss's Law, Mechanical force of charge surface, Energy per unit volume.

UNIT-II

Magnetism: Magnetic induction, Magnetic flux, Solenoidal nature of vector field of induction, Properties of \vec{B} (i) $\vec{\nabla} \cdot \vec{B} = 0$, (ii) $\vec{\nabla} \times \vec{B} = \mu \vec{J}$, Electronic theory of diamagnetism and paramagnetism, Domain theory of ferromagnetism (Langevin's theory), Cycle of magnetization-Hysteresis loop (Energy dissipation, Hysteresis loss and importance of Hysteresis curve).

UNIT-III

Electromagnetism: Maxwell equations and their derivations, Displacement current, Vector and Scalar potentials, Boundary conditions at interface between two different media, Propagation of electromagnetic wave (Basic idea, no derivation), Poynting vector and Poynting theorem.

UNIT-IV

A.C. Analysis: A.C. circuit analysis using complex variable with (a) capacitance and resistance (CR) (b) resistance and inductance (LR) (c) capacitance and inductance (LC) (d) capacitance, inductance and resistance (LCR). Series and parallel resonant circuit, Quality factor (sharpness of resonance).

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