

DEPARTMENT OF PHYSICS

SYLLABUS 2017-18

B. Sc. I Year

Paper I : Mathematical Physics, Mechanics and Properties of Matter

(गणितीय भौतिकी, यांत्रिकी एवं द्रव्य के सामान्य गुण)

Unit-I: Mathematical Physics

Addition, subtraction and product of two vectors; Polar and axial vectors and their examples from physics; Triple and quadruple product (without geometrical applications); Scalar and vector fields; Differentiation of a vector; Repeated integral of a function of more than one variable; Unit tangent vector and unit normal vector; Gradient, Divergence and Curl; Laplacian operator; Idea of line, surface and volume integrals; Gauss', Stokes' and Green's Theorems

Unit-II: Mechanics

Position, Velocity and Acceleration Vector, Components of velocity and acceleration in different coordinate systems, Newton's Laws of motion and its explanation with problems, various types of forces in nature (explanation), Pseudo Forces (e.g. Centrifugal Force), Coriolis force and its applications. Motion under a central force, Derivation of Kepler's laws. Gravitational law and field, Potential due to a spherical body. Gauss & Poisson's equation of Gravitational self-energy. System of particles, Centre of mass and reduced Mass. Elastic and inelastic collisions.

Unit-III: General Properties of Matter

elastic moduli and their relations, Determination of Y of rectangular thin bar loaded at the centre; Torsional oscillations, Torsional rigidity of a wire, to determine η by torsional oscillations. Surface Tension, Angle of Contact, Capillary Rise Method; Energy required to raise a liquid in capillary tube; Factors affecting surface tension; Jaeger's method for Determination of surface tension; Applications of Surface Tension, Concept of Viscous Forces and Viscosity; Steady and Turbulent Flow, Reynolds's number; Equation of Continuity; Bernoulli's Principle; Application of Bernoulli's equation - (i) Speed of Efflux (ii) Venturimeter (iii) Aspirator Pump (iv) Change of plane of motion of a spinning ball.

Unit-IV: Oscillations

Concept of Simple, Periodic & Harmonic Oscillation with illustrations; Differential equation of harmonic oscillator (simple pendulum, spring mass system); Kinetic and potential energy of Harmonic Oscillator; Oscillations of two masses connected by a spring; Translational and Rotational motion, Moment of Inertia, Theorem of perpendicular axis, Theorem of parallel axis, Moment of inertia of regular bodies (rod, disc and solid cylinder) Product of moment of inertia, Principal moments and axes, Motion of Rigid Body, Euler's equation.

Unit-V: Relativistic Mechanics

Relativistic Mechanics: Michelson-Morley experiment and its outcome; Postulates of Special Theory of Relativity; Lorentz Transformations. Simultaneity and order of events; Lorentz

contraction; Time dilation; Relativistic transformation of velocity, frequency and wave number; Relativistic addition of velocities; Variation of mass with velocity.

Earlier Developments in Physics up to 18th Century: Contributions of Aryabhata, Archimedes, Nicolaus Copernicus, Galileo Galilei, Huygens, Robert Hooke, Torricelli, Vernier, Pascal, Kepler, Newton, Boyle, Young, Thompson, Coulomb, Amperes, Gauss, Biot-Savarts, Cavendish, Galvani, Franklin and Bernoulli.

Reference Books:

1. University Physics: Sears and Zeemansky, XIth edition, Pearson education
2. Concepts of Physics: H C Verma , Bharti Bhavan Publisher
3. Problems in Physics: P.K Shrivastava Wiley Eastern Ltd.
4. Berkley Physics Course Vol. 1.Mechanics:E M Purcell,Mcgraw Hill
5. Properties of Matter: D S Mathur, ShamLal Cheritable Trust New Delhi
6. Mechanics: D S Mathur, S Chand And Company New Delhi
7. The Feynman Lectures in Physics Vol.1:R P Feynman,R B Lighton and M.Sands

DEPARTMENT OF PHYSICS

SYLLABUS 2017-18

B. Sc. I Year

Paper II : Thermodynamics and Statistical Physics

(उष्मागतिकी और सांख्यिकीय भौतिकी)

Unit-I: Thermodynamics-I

Reversible and irreversible process, Heat engines, Definition of efficiency, Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of Second law of thermodynamics, Carnot's theorem, Clapeyron's latent heat equation, Carnot's cycle and its applications, Steam engine, Otto engine, Petrol engine, Diesel engine.

Unit II: Thermodynamics-II

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle. Principle of increase of entropy, Change in entropy in irreversible process.

T-S diagram, Physical significance of Entropy, Entropy of a perfect gas, Kelvin's thermodynamic scale of temperature, The size of a degree, Zero of absolute scale, Identity of a perfect gas scale and absolute scale.

Third law of thermodynamics, Zero point energy, Negative temperatures (not possible), Heat death of the universe. Relation between thermodynamic variables (Maxwell's relations).

Unit-III: Statistical Physics-I

Description of a system: Significance of statistical approach, Particle-states, System-states, Microstates and Macro-states of a system, Equilibrium states, Fluctuations, Classical & Statistical Probability, The equi-probability postulate, Statistical ensemble, Number of states accessible to a system, Phase space.

Micro Canonical Ensemble, Canonical Ensemble, Helmholtz free energy, Enthalpy, First law of thermodynamics, Gibbs free energy, Grand Canonical Ensemble.

Unit-IV: Statistical Physics-II

Statistical Mechanics: Phase space, The probability of a distribution, The most probable distribution and its narrowing with increase in number of particles, Maxwell-Boltzmann statistics, Molecular speeds, Distribution and mean, r.m.s. and most probable velocity, Constraints of accessible and inaccessible states.

Quantum Statistics: Partition Function, Relation between Partition Function and Entropy, Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results, Concept of Phase transitions.

Unit-V: Contributions of Physicists

S.N. Bose, M.N. Saha, Maxwell, Clausius, Boltzmann, Joule, Wien, Einstein, Planck, Bohr, Heisenberg, Fermi, Dirac, Max Born, Bardeen.

Text and Reference Books:

1. Heat and Thermodynamics: Mark W. Zemansky, Richard H Dittman, Seventh edition, Mcgraw Hill International edition
2. Thermal Physics (Heat and Thermodynamics): A B Gupta, H P Roy, Books and allied(P) Ltd.Calcutta
3. Heat and Thermodynamics: Brijlal and N Subramanyam, S Chand and company Ltd. New Delhi
4. Berkley Physics Course Vol 3. Thermodynamics: F Reif, Mcgraw Hill
5. Thermodynamics and Statistical Physics: D.P. Khandelwal and A.K. Pandey, Himalaya Publications
6. Laboratory Manual of Physics for under graduate classes: D.P. Khandelwal, Vani publishing house, New Delhi.