COURSES OF STUDY
for
B.Sc. (Honours) Part I Examination
PHYSICS (HONOURS)
Paper I
(Mechanics and General Physics)

Time - 3 hours **Full Marks - 75**

Twelve questions to be set. Six to be answered (taking not more than two from each group)

Group A
Vector and Relativity (Four questions to be set)

Scalar and Vector Fields : Gradient, Divergence and Curl; Line, Surface and Volume integrals. Theorems of Gauss, Stoke and Green Theorems.

The Lorentz Transformations: Galilean Transformation, Newtonian relativity. Instances of their failure; Electromagnetism, Aberration of light, Michelson - Morley Experiment. Einstein's basic postulates and geometric derivation of Lorentz Transformations; Length contraction, Simultaneity, Time dilation. Einstein's velocity addition rule, Doppler effect in light.

Group B
Mechanics of Particles & Continuous Media
(Four questions to be set)

Intertial frame of reference and non-inertial frame, Coriolis and centrifugal forces and their simple application.

Motion under a central force; conservation of angular momentum, Kepler's laws, Geostationery Satellite.

Elastic constants for an isotropic solid, their inter-relation, Torsion of a cylinder, Bending of beam, Flat spiral spring.

Kinematics of moving fluids; Equation of continuity, Euler's equation, Bernoulli's theorem.

Viscous fluids; Streamline and turbulent flow, Flows of incompressible and compressible fluids through a capillary tube, Reynold's Number, Stokes' Law.

Surface tension and surface energy; molecular interpretation, Pressure on a curved liquid surface.

Group C

Oscillations, Waves and Acoustics

(Four questions to be set)

Free and damped oscillations in one dimension, critical damping, Q of an oscillator, Forced oscillator with one degree of freedom, Resonance.

Waves in continuous media, Speed of longitudinal waves in a fluid, Energy density and energy transmission in waves, Concept of group velocity and phase velocity..

Fourier analysis; Fourier series and Fourier coeffecients; Simple examples of rectangular, Saw-tooth wave and transverse vibration of strings.

Transducer and their characteristics, Recording and reproduction of sound, Measurement of frequency, velocity, Wave form and intensity. The accoustics of halls, Reverberation period, Sabine's formula.

Books Recommended :

1. **R. P. Feynman, R. B. Leighton and M. Sands;** "The Feynman Lectures on Physics" **Vol. I**(B. I. Publications, Bombay-Delhi-Calcutta-Madras)
2. **S. P. Puri** "Vibrations and Waves" (Tata MacGraw-Hill)
3. **D. P. Khandelwal;** "Oscillations and Waves" (Himalaya Publishing House, Bombay)
4. **R. K. Ghosh;** "Theory of Mathematics of waves and vibrations" (McMilan, 1975)
5. **Newman and Searle;** "General Properties of Matter"
6. **Takwale and Puranic;** "Classical Mechanis"
7. **Landau & Lifshitz;** "Theoratical Physics - Part I"
8. **H. J. Pain;** "Waves and oscillations"

PHYSICS (HONOURS)

Paper II

(HEAT AND THERMODYNAMICS)

Time - 3 hours **Full Marks - 75**

Twelve questions to be set. Six to be answered (taking at least

two from each group)

Group A

Kinetic Theory (Six questions to be set)

Maxwellian distribution of speeds in an ideal gas. Derivation of the distribution of speed and velocity and its experimental verification. Equipartition of energy; Specific heats of gases.

Real gas : vander Waal's model, Equation of state, Nature of vander Waal's forces, Critical constants.

Transport phenomena: Mean free path, Transport of momentum (viscosity), Energy(thermal conduction) and matter (diffusion)

Group B

Thermodynamics (Six questions to be set)

The Laws of Thermodynamics : The zeroth law; the first law, Carnot's theorem, the second law, Entropy as a thermodynamic variable; Principle of increase of entropy. Thermodynamic scale of temperature; its identity with perfect gas scale, Impossibility of attaining the absolute zero (third law).

Thermodynamic relationship : Maxwell's equations and their applications.

Thermodynamic potentials : Relation to thermodynamic variables; equilibrium in thermodynamic systems, Simple applications.

Joule - Thomson and adiabatic cooling : Joule - Thomson expansion; constants of U+PV, cooling in J - T expansion, Adiabatic expansion of an ideal gas, Principles of regenerative and cascade cooling, liquefaction of gases.

Low temperatures : Production and measurement of very low temperatures.

Black body radiation : temperature radiation, Stefan - Boltzmann law, spectral distribution, Wien's displacement law, Rayleigh - Jeans law and the ultraviolet catastrophy. Planck's hypothesis, mean energy of an oscillator and Planck' law.

Books Recommended :

1. **M. W. Zemansky;** "Heat and Thermodynamics" (McGraw-Hill)
2. **Saha & Srivastava;** "A treatise on Heat"

3. **J. B. Rajam;** "Heat and Thermodynamisc"

PHYSICS (HONOURS)
Practical

Time - 6 hours **Full Marks -50**

(One experiment to be performed in examination)

(Expt.- 30, viva-12, NB- 8)

The course shall include the following experiments

1. Kater's pendulum, Precise setting and analysis.
2. Study of laws of parallel and perpendicular axes for estimation of moment of interia.
3. Study of flexure of a bar.
4. Study of torsion of a wire; dependence on radius, length, torque and material (static method}
5. Study of torsion of wire or fibre; dynamic method.
6. Study of flow of liquids through capillaries; laminar and tubulent flow stages, Capillaries in series.
7. Studying the fall of solids through a liquid.
8. Study of airflow through a capillary; U-tube with long capillary fitted on one arm, mercury level difference pushing air.
9. Searl's method for Y, $\eta$and σ from a single set.
10. Thermal conduction in poor conductor : temperature distribution using thermocouples in cases of linear geometry (sheets or slabs), cylindrical geometry, spherical geometry. Study of thermionic emmision from metals.
11. Study of harmonic oscillation and its relaxation; rigid pendulum or torsional oscillations.
12. Oscillations of a bifilar suspension.
13. Study of dependence of period of oscillations of a spring or rubber band on mass and spring constant.
14. Study of transverse wave speed on a string; dependence on density and tension (sonometer)
15. Study of wave velocity in a gas; Kundt's tube.
16. Melde's experiment.