35. Physics

B.Sc. Physics-I **Total Mark: 100**

Appendix 'A'

(Outlines of Tests)

Paper-A:	(Written)	75 Marks
Section-I:	Mechanics (4 Q)	
Section II:	Waves, Oscillations and Optics (3 Q)	
Section III:	Thermodynamics and Kinetic theory of gases (3 Q)	
Paper-B:	Mechanics, Thermodynamics, Sound and Optics (Practical)	25 Marks

Note:

"Out of the Whole Syllabus (for a paper) there will be 10 questions as usual and the candidate will have to attempt 5 out of 10 questions. However;

There will be three Sections. Section I will be of four questions while remaining two sections will have three questions each. The candidate will have to attempt five (5) questions selecting not more than two (2) questions from each section.

Furthermore there will be 2 to 3 parts of question in each Section. One of the parts will be either numerical or a question related to the Physical significance of the topic (conceptual question)."

Appendix 'B'

(Syllabi and Courses of Reading)

Paper-A: Written (Time: 3 Hours) **75 Marks**

Note: Attempt five (5) questions selecting not more than two (2) questions from each section.

Sr. No.	Section	Subject
1	Section-I	Mechanics
2	Section-II	Waves, Oscillations and Optics
3	Section-III	Thermodynamics and Kinetic theory of gases

Section-I: Mechanics:

V Ector Operations:

Topic	Scope
Vector in 3 dimensions	Introduction: Direction cosines Spherical polarco-ordinates: applications
Vector derivatives and operation	Divergence and curl of a vector, and gradient of a scalar point functions.

Gradient Divergence and Curl of a vector point function	Physical application of each type; Divergence, curl of a vector field, surface & line integrals and their mutual relationships.
Divergence Theorem	Derivation, physical importance and application to specific cases. Converting from differential to integral forms
Stokes' Theorem	Derivations, physical significance and applications to specific cases.
PARTICLE DYNAMICS	
TOPIC	SCOPE
Advanced application of Newton's laws. Dynamics of uniform motion	Frictional forces : microscopic basis of this force Conical pendulum: The rotor circular and the banked curve.
Equations of motion	Deriving kinetic equations x(t). v(t) using integrations. Constant and non-constant forces and special examples
Time-dependent forces	Obtain x(t). v(t) for this case using integration method.
Effect of drag forces on motion	Apply Newton's Laws to obtain v(t) for the case of motion with time dependent drag (viscous
Non-intertial frames and Pseudo forces	Qualitative discussion to develop understanding. Calculation of pseudo forces for simple cases (linearly accelerated reference-frames). Centrifugal forces as an example of pseudo force: carioles force.
Limitations of Newton's Laws	Discussion
Suggested Level	Ch: 6 R.H.K.
Work and Energy	
Topic	**Scope**
Work done by a constant force. Work done by a variable force (1- dimension).	Essentially a review of grade-XII concepts, use of integration technique to calculate work done (e.g. in vibration of a spring obeying Hookes Law
Work done by a variable force (2-dimensional case)	Obtaining general expression for force and applying to simple cases e.g.. pulling a mass at the end of a fixed string against gravity.

Work-energy theorem. General proof of work energy theorem.	Qualitative review of work energy theorem. Derivation using integral calculus. Basic formula: and applications.
Power	
Reference Frames	Energy changes with respect to observers in diferent inertial frames
Suggested level.	Ch. 7 of R.H.K
Conservation of Energy	
Topic	**Scope**
Conservative and non-conservative Forces	Definition of either type of force & examples: work done in a closed path 1- D conservative system: force as the gradient of potential energy: applications to the case of a spring and force of gravity.
One dimensional conservative system	Obtaining velocity in terms of U and E: stable unstable and neutral equilibrium. Analytic solution for x(t).
2 and 3-dimensional conservative systems	Change in P.E. for motion n 3-d. forces as the gradient of the potentials. Work done in 2 and 3-dimensional motion.
Conservation of energy in a system of particles	Law of conservation of total energy of an isolated system.
Suggested level	Ch: 8 of H.RK
Systems of Particles	
Topic	**Scope**
Two particle systems and generalization to many-particle system	Center of mass: Its position, velocity and equation of motion.
C enter of mass of solid objects	Calculation of center of mass of solid objects using integral calculus. Calculating the CM. of:
	Uniform Rod Cylinder Sphere
Momentum changes in a system of variable mass	Derivation of basic equation application to motion of a rocket (determination of its mass as a function of time)
Suggested level	Ch. 9 of R.H.K.

Collisions	
Topic	
Angular momentum; angular velocity	Definition, conservation of angular momentum, effects of Torque.
Overview of rotational Dynamics.	Relationships between linear & angular variables; scalar and vector form. Kinetic energy of rotation; Moment of Inertia.
Parallel axis theorem.	Prove and illustrate; apply to simple cases
Determination of moment of inertia of various shapes	Equations of rotational motion and effects of applications of torques.
Rotational dynamics of rigid bodies	
Combined rotational and transnational motion	Rolling without slipping
Stability of spinning objects	Discussion with examples Effects of torque on the angular momentum
The spinning Top	Precessional motion.
Suggested level	Ch. 12 & 13 H.R.K
Gravitation	
Topic	**Scope**
Review of basic concepts of gravitation. Gravitational effect of a spherical mass distribution	Mathematical treatment.
Gravitational Potential Energy	Develop using integration techniques, calculation of escape velocity
Gravitational field & Potential	Develop the idea of field of force.
Universal Gravitational Law	Motion of planets and Kepler's Laws, (Derivation & explanation). Motion of satellites. Energy considerations in planetary and satellite motion. Qualitative discussion on application of gravitational
Suggested level	Ch: 16 H.R.K
Bulk Properties of Matters	
Topic	**Scope**
Review of basic concepts of gravitation Gravitational effect of a spherical mass distribution.	Mathematical Treatment
Gravitational Potential Energy	Develop using integration techniques, calculation of escape velocity
Gravitational field & Potential	Develop the idea of field of force.
Universal Gravitational Law	Motion of plants and Keplers Law, (Derivation & explanation) Motion of Satellites. Energy considerations in planetary and satellite motion Qualitative discussion on application of gravitational law to the Galaxy
Suggested levels	Ch: 14 H.R.K.
Fluid Statistics	Variation of pressure in fluid at rest and with height in the atmosphere.
Surface tension.	Physical basis: role, information of drops and bubbles.
Suggested levels:	Ch: 17 H.R.K.

Fluid Dynamics	General concepts of fluid flow: streamline and the equation of continuity.
Bernoulli's Equation	Derivation and some applications such as dynamic lift, thrust on a rocket
Viscosity	Physical basis: obtaining the coefficient of viscosity.
	practical examples of viscosity: fluid flow (Poiseuille's law)
Suggested level	Ch. 18. H.R.K.
Special Theory of Relativity	
Topic	**Scope**
Trouble with Classical Mechanics	Qualitative discussion of the inadequacy of paradoxes in classical ideas of time, length and velocity.
Postulates of Relativity The Lorentz Transformation, Inverse Transformation	Statements and discussion. Derivation. Assumption on which derived, application of the same transformation of velocities
Consequences of Lorentz transformation	Relativity of time; Relativity of length
Relativstic momentum	Derivation
Relativstic energy	Derivation of E = mc2
Suggested level	Partially covered by Ch: 21 of H.R.K
Section-II **Waves, Oscillations and Optics:** **Waves**	
Topic	**Scope**
Mechanical waves, Traveling waves	Phase velocity of traveling waves: sinusoidal
	waves: Group speed and dispersion.
Waves Speed	Mechanical analysis
Waves equation	Discussion of solution
Power and intensity in wave motion	Derivation & discussion
Principle of superposition, (basic ideas).	Interference of waves, standing waves, Phase changes on reflection, natural frequency and resonance.
Suggested level	Ch: 19 of H.R. K

Oscillations	
Topic	**Scope**
Simple harmonic oscillation (SHM)	Obtaining and solving the basic equation of motion x(t). v(t). Energy consideration in SHM (viscous) forces, terminal velocity. Projectile motion/air resistance.
Application of SHM	Torsional Oscillator. Physical pendulum, simple pendulum.
SUM and uniform circular motion combinations of harmonic motions	Lissajous patters
Damped Harmonic Motion	Equation of damped harmonic motion discussion of its solution.
Suggested level	Chapter 15 of RHK
Sound	
Topic	**Scope**
Beats phenomenon	Analytical treatment
Doppler Effect	Moving source, moving observer, both object and source moving.
OPTICS Interference	Coherent sources. Double slit interference (analytical treatment).
Adding of electromagnetic waves (Phasor method)	
Interference from thin films	Newton's rings (analytical treatment)
Michelson Interferometer	Discussion to include the use of a compensating plate. Michelson interferometer and its use in determining the velocity of light.
Fresnel Biprism	Basic ideas and usage.
Suggested level	Ch: 45 of H.R.K.
Diffraction	Diffraction at single slit. Intensity in single slit, diffraction using Phasor treatment, analytical treatment using addition of waves. Slit interference & diffraction combined. Diffraction at a circular aperture
Diffraction from multiple slits	Discussion including width of the maxima
Diffraction grating	Discussion, use in spectrographs. Dispersion and resolving power of gratings.
Suggested level	Ch: 46. 47 of H.R.K.
Holography	Qualitative discussion
Polarization	Basic definition production of polarization by polarizing sheets by reflection, by double refraction and double scattering.
Description of polarization states	Linear, Circular and elliptic polarization.
Rotation of plane of polarization	Use of polarimeter.
Suggested level	Ch. 48 of H.R.K

Section-III

Thermodynamics and Kinetic Theory of Cases:
Temperature:

Topic	Scope
Concept of temperature and Zeroth law of thermodynamics	
Kinetic theory of the ideal gas. work done on/by an ideal gas	Review of previous concepts
Internal energy of an ideal gas	To include the equipartition of energy
Intermolecular forces	Van der Waals equation of state
Quantitative discussion.	
Suggested level	Ch. 21.22 of H.R.K (Vol-1)

Statistical Mechanics

Topic	Scope
Statistical distribution and mean values	Mean free path and microscopic calculations of mean free path.
Distribution of molecular speeds	Maxwell distribution; Maxwell-Boltzmann energy distribution, internal energy of an ideal gas.
Brownian motion	Qualitative description, Diffusion, Conduction and Viscosity.
Suggested level	Ch:22 of H.R.K. Vol-I

Heat

Topic	Scope
Review of previous concepts. First law of thermodynamics, transfer of heat	First law of thermodynamics & its applications, cyclic and free expansion.
Suggested level	Ch:23 of H.R.K Vol.I

Entropy and Second Law of Thermodynamics

Topic	Scope
Reversible and irreversible process	Definition and discussion
Second Law	Definition, Heat engine, Refrigerators and Second
Cycle: Carnot engines	Calculation of efficiency of heat engines.
Thermodynamic temperature scale	Absolute zero, negative temperature (discussion)
Entropy	Entropy in reversible process.
	Entropy in irreversible process.
	Entropy and second law of thermodynamics.
	Entropy & probability.
Suggested level	Ch:24 of H.R.K

Paper-B: Mechanics, Thermodynamics, Sound and Optics (Practical) 25 Marks

Sr. No.	Subject
1	Mechanics
2	Waves, Oscillations and Optics
3	Thermodynamics and Kinetic Theory of Gases

List of Experiments for Practical Paper "B"

1. Mechanics:

1. To determine surface tension by capillary rise.
2. To study the compound pendulum and estimate of value of " g
3. To determine Elastic constant by spiral spring.
4. To determine modulus of rigidity by dynamic method and static method of Maxwell's Needle.

2. Waves, Oscillations and Optics:

5. To study the Lissajous figures by using C.R.O.
6. To determine the frequency of an A.C. supply.
7. To determine velocity of sound by Kundt's tube
8. To study the principle of sextent and measure the altitude of a given point by using it.
9. To determine wavelengths of sodium D lines by Newton's rings.
10. To determine wavelength of light by Fresrel's biprism.
11. To determine wavelength of light by diffraction grating.
12. To measure the rotation of the plane of polarization.
13. To determine the resolving power of a diffraction grating

3. Thermodynamics and Kinetic Theory of Gases:

14. To study the principle of thermocouple, thermal e.m.f. and temperature diagram.
15. To determine the mechanical equivalent of heat, "J" by Electrical Method (Calendar and Barnes Method).
16. To determine the temperature coefficient of a resistor