B.Sc. PART I PHYSICS EXAMINATION

Scheme of examination:

Three Theory Papers	Min.Pass Marks 54	Max. Marks 150
Paper-I: Mechanics	3 hrs. Duration	50 marks
Paper-II: Waves and Oscillations	3 hrs. Duration	50marks
Paper-Ill: Electromagnetism	3 hrs. Duration	50 marks
Practical 5 hrs. Duration	Min. Pass marks 27	Max. Marks 75

Note: There will be two experiments of 5 hrs. duration. The distribution of 75 marks will be as follows:

Two experiments (one-from each group) each of 25 marks	-	50
Viva	-	15
Record	-	10
Total		75

Workload:

Each paper must be given 2 hrs. per week for theory. Practical must be given 4 hrs per week. For laboratory work-each batch must not be of more than 20 students.

Syllabus:

PAPER I - MECHANICS

Duration: 3 hrs. Max.Marks: 50

NOTE - Question paper will have three part viz. Part-A (15 marks), Part- B (15 Marks) and Part-C (20 Marks). Students are required to answer, all ten very short type questions (50 words each) in Part-A. Each question carry 1.5 mark.

Part-B, answer all five short type questions (100 words each). Internal choice has been given to each question. Each question carry 03 marks.

In Part-C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question.The marks in this Part will be 7+7+6=20 marks.

UNIT-I

Inertial frames, Galilean transformation, Non-inertial frames, fictitious forces, Displacement, velocity and acceleration in rotating co-ordinate systems, centrifugal acceleration, Coriolis force and its applications, Focault pendulum, Invariance of velocity of light, postulates of special theory of relativity, Lorentz transformations, relativistic addition of velocities, length contraction, time dilation. Variation of mass with velocity, mass energy relation.

Motion under central force, Kepler's laws, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self energy.

UNIT-II

System of particles, centre of mass, motion of centre of mass, concept of reduced mass, single stage and multistage rocket, energy and momentum conservation, concepts of elastic and inelastic collisions, Analysis of collision in centre of mass frame.

Angular momentum of a system of particles, Conservation of angular momentum, angular momentum about an arbitrary point, rigid body motion. Rotational motion, equation of motion of a rotating body, inertial coefficients, case of J not parallel to w, kinetic energy of rotation and idea of principles axes, Euler's Equations, Precessional motion of Spinning top, Spin precession in constant magnetic field Calculation of moment of inertia of a spherical shell, hollow and solid spheres and cylindrical objects (cylindrical shell, solid cylinder) about their symmetric axes through centre of mass.

UNIT-III

Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli's theorem, Viscous fluids, Stream line and Turbulent flow, Poiseuille's law, Capillary tube flow, Reynold's number, Stokes

law, Surface tension and surface energy, molecular interpretation of surface tension, Pressure on a curved liquid surface, wetting.

Elasticity, Small deformations, Young's modulus, Bulk modulus and Modulus of rigidity for an isotropic solid, Poisson ratio, relation between elastic constants. Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces. Experimental determination of elastic constants by bending of beam.

Text and Reference Books:

1. Berkeley Physics Course Vol-I, Mechanics (Mc Graw-Hill)
2. The Feymman Lectures in Physics, Vol-I, R.P. Feymman, R.B. Lighton and M. Sands.
3. R. S. Gambhir-Mechanics, (CBS Publishers and Distributors, New Delhi.)

PAPER-II WAVES & OSCILLATIONS

Duration: 3 hrs. Max.Marks: 50

NOTE - Question paper will have three part viz. Part-A (15 marks), Part- B (15 Marks) and Part-C (20 Marks). Students are required to answer, all ten very short type questions (50 words each) in Part-A. Each question carry 1.5 mark.

Part-B, answer all five short type questions (100 words each). Internal choice has been given to each question. Each question carry 03 marks.

In Part-C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. The marks in this Part will be 7+7+6=20 marks.

UNIT-I

Potential well and periodic oscillations, cases of harmonic oscillations, differential equations and its solution. Kinetic and potential energy. Simple harmonic oscillations in-Spring and mass system, Simple and compound pendulum, Torsional pendulum, Bifilar oscillations, Helmholtz resonator, LC circuits, oscillation of magnet, Oscillation of two masses connected by a spring. Superposition of two simple harmonic motions of same frequency along the same line, Interference, Damped harmonic oscillators, Power dissipation, Quality factor, Driven harmonic oscillator, Transient and steady state, Power absorption, Motion of two coupled oscillators, normal modes and motion in mixed mode effect of coupling in mechanical systems. N coupled oscillators.

UNIT-II

Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in Waves, Typical measurement, Waves over liquid surface, gravity waves and ripples, Group velocity and phase velocity, their measurements, superposition's of waves linear homogeneous equations and the superposition principle, nonlinear superposition and consequences.

Standing waves: Standing waves as normal modes of bounded systems, Harmonics, the quality of sound: examples. Chladni's figures and vibrations of a drum. Production and detection of ultrasonic and infrasonic waves and applications.

UNIT-III

Noise and Music : The human ear and its responses: limits of human audibility. Intensity and loudness, bel and decibel, the musical scale. Temperament and musical instruments.

Reflection. Refraction and diffraction of sound: Acoustic impedance of a medium. Percentage reflection and refraction at a boundaiy. Impedance matching for transducers, diffraction of sound, principle of a sonar system. Sound ranging.

Applied acoustics: Transducers and their characteristics. Recording and reproduction of sounds. Various systems, Measurements of frequency. Waveform. Intensity and velocity. The acoustics of halls. Reverberation period. Sabine's formula.

Plane electromagnetic waves in vacuum, Wave equation for E and B of linearly, circularly and elliptically polarized electromagnetic waves, Poynting vector; Reflection and refraction at a plane boundary of dielectrics, Polarization by reflection and total internal reflection, Faraday effect, Wave in conducting medium, Reflection and refraction by the ionosphere.

Text and Reference books:

1. D. P. Khandelwal - Oscillation and waves (Himalaya Publishing House, Mumbai).
2. R.K. Ghose - The Mathematics of waves and vibrations.
3.S.N. Ghose - Electromagnetic theory and waves propagation(Narosa Pub. House).
4. V.V. Savate - Electromagnetic field and waves (Wiley Eastern Ltd. N.Delhi).
5.I.G Main - Vibrations and waves (Cambridge Univ Press).
6.H.J. Pain - The Physics of vibrations and waves (Macmilan 1975).
7. Berkley-Physics course, Vol. Ill "Waves and Oscillations".

PAPER-III - ELECTROMAGNETISM

Duration: 3 hrs. Max. Marks: 50

NOTE - Question paper will have three part viz. Part-A (15 marks), Part- B (15 Marks) and Part-C (20 Marks). Students are required to answer, all ten very short type questions (50 words each) in Part-A. Each question carry 1.5 mark.

Part-B, answer all five short type questions (100 words each). Internal choice has been given to each question. Each question carry 03 marks.

In Part-C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. The marks in this Part will be 7+7+6=20 marks.

UNIT-I

Scalars and Vectors: dot products, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integral, Flux of vector field, Gauss's divergence theorem, Green's theorem and Stokes theorem. Gauss's Law and its integral and differential form. Coulomb's law in vacuum expressed in vector forms, Potential and field of an arbitrary charge distribution at rest, Concept of multi poles, dipole and quadruple potentials and field, Work done on a charge in an electrostatic field expressed as a line integral, Conservative nature of the electrostatic field and relation with Electric potential ϕ.

Torque on a dipole in a uniform electric field and its energy, Electrostatic energy of uniformly charged sphere, classical radius of an electron. Screening of E field by a conductor.

UNIT-II

Electric field in matter: atomic and molecular dipoles, permanent dipole moment, dielectrics, polarisability, polarization vector, capacity of parallel plate capacitor with partially or completely filled dielectric, electric displacement, electrostatic energy of charge distribution in dielectric, Lorentz local field and Clausius Mossotti equation.

Electrostatic field - conductors in electric field, Boundary conditions for potential and field at dielectric surface, uniqueness theorem, method of images and its applications for system of a point charge near a grounded conducting plane, Poisson's and Laplace's equations in Cartesian, cylindrical and spherical polar coordinates (without derivation), solutions of Laplace's equations in Cartesian coordinates, potential at a point inside a rectangular box.

UNIT-III

Ampere circuital law (integral and differential form), divergence of magnetic field, force on a current carrying wire and torque on a current loop in a magnetic field, magnetic dipole moment, magnetization vector, magnetisation current half order field, magnetic permeability (Linear cases) Maxwell's equations

(integral and differential form) and displacement current. E as an accelerating field: Electron gun, case of discharge tube, linear accelerator, E as deflecting field : CRO, sensitivity of CRO.
Electromagnetic induction, Faraday law (its integral and differential form) Lenz's law, mutual & self inductance, measurement of self inductance by Rayleigh's method, Charging, discharging of condensor through resistance, rise and decay of current in LR circuit, decay constant, transient in LCR circuit. AC circuit: complex number and their application in solving AC circuits, complex impedance and reactance. Series and Parallel resonance, Q-factor and sharpness of resonance.

Text and Reference Books:

1. Berkeley Physics Course, Electricity and Magnetism, Ed. E.M. Procell (Me Graw Hill)
2. Haliday and Resnik, 'Physics'-Vol. II
3.D. J. Grifth "Introduction to electrodynamics", (Prentice Hall of India.)
4.A.M.Portis, 'Electromagnetic field'.
5.V.V. Savate, 'Electromagnetic field and Waves', (Wiley Eastern Ltd., New, Delhi.)
6.Kakani and Hemrajani, 'Electromagnetism theory and Problems,(CBS Publishers and Distributers, New Delhi.)

PHYSICS PRACTICALS

Duration: 5 hrs Min.Pass Marks 27 Max. Marks 75

In addition to the experiments listed below few more experiments may be set at institution level, at par with the Standard of B.Sc. Part I. Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section. In examination two experiments are to be performed taking at least one from each section. The lab tutorials are to be done in lab. Classes, so that these may be applied in regular lab work.

Section: A

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. Study of conservation of momentum in two dimensional oscillations.
3. Study of a compound pendulum.
4. Study of damping of a bar pendulum under various conditions. .
5. Study of oscillations under a bifilar suspension.
6. Potential energy curves of a one dimensional system and oscillations in it for various amplitudes.
7. Study of oscillations of a mass under different combinations of springs.
8. Study of bending of a cantilever or a beam.
9. Study of torsion of a wire (static and dynamic methods)
10. Study of flow of liquids through capillaries.
11. Determination of surface tension of a liquid by different methods.
12. Study of viscosity of a fluid by different methods.
13. Conversion of galvanometer into ammeter/voltmeter

Section: B

1. Characteristics of a ballistic galvanometer.
2. Setting up and using an electroscope or electrometer.
3. Use of a vibration magnetometer to study a magnetic field.
4. Study of magnetic field due to a current.
5. Measurement of low resistance by Carey-Foster bridge or otherwise.
6. Measurement of inductance using impedance at different frequencies.
7. Measurement of capacitance using impedance at different frequencies.
8. Study of decay of currents in LR and RC circuits.
9. Response curve for LCR circuit and resonance frequency and quality factor.
10. Sensitivity of cathode-ray oscilloscope.
11. Characteristics of a choke.

12. Measurement of inductance:
13. Study of Lorentz force.
14. Study of discrete and continuous LC transmission lines.

Laboratory Tutorials (any eight)

1. Elementary Fortran programs, flowcharts and their interpretation.
2. To print out all natural even/odd numbers between given limits,
3. To find maximum, minimum and range of a given set of numbers.
4. To compile a frequency distribution and evaluate moments such as mean; Standard deviation etc.
5. To evaluate sum of finite series and the area under a curve.
6. To find the product of two matrices.
7. To find a set of prime numbers and Fibonacci series.
8. Motion of a projectile using computer simulation.
9. Numerical solution of equation of motion.
10. Motion of particle in a central force field.
11. To find the roots of a quadratic equation.

Text and Reference books

1. Raj Kumar - Practical Physics.
2. Gupta Kumar - Practical Physics.
3. D.P. Khandelwal - Manual of Practical Physics (Alka Publication, Ajmer)
4. Prof. Saraf - Physics through experiment.
5. Practical Physics by CBH Jaipur.
6. Practical Physics by RBD Jaipur.