B.Sc.Part-I

PHYSICS

Scheme:

Paper	Exam. Duration	Minimum Pass Marks	Maximum Marks
Paper- I	3 Hours	18	50
Paper- II	3 Hours	18	50
Paper- III	3 Hours	18	50
Practical Exam	4 Hours	18	50

Paper – I (MECHANICS)

Work load: Two hours lecture per week. Examination Duration: Three Hours

Note:- Total Five questions to be attempted. First question will consist of eight short answer type questions and is compulsory. Four questions will be from four units, one from each unit with internal choice. 40% weightage will be given to problems and numerical. The candidates will be required to attempt all the five questions. All five questions have equal weightage (each question is of 10 marks).

UNIT-I

Physical law and frame of reference

(a) Inertial and non-inertial frames, Transformation of displacement, velocity, acceleration between different frames of references involving translation, Galilean transformation and Invariance of Newton's laws

(b) **Special theory of relativity**: Postulates of special theory of relativity, Lorentz transformation, transformation of velocity and acceleration, Length contraction and time dilation with experimental verification

(c) **Coriolis Force**: Transformation of displacement, velocity and acceleration between rotating frame, Pseudo Forces, Coriolis force, motion relative to earth, Focult's Pendulum

UNIT-II

Centre of Mass: Introduction about centre of mass, Centre of Mass Frame: Collision of two particles in one and two dimensions (elastic and inelastic), Slowing down of neutron in a moderator, Motion of a system with varying mass, Angular momentum concept, conservation and charge particle scattering by a n nucleus

Rigid body: Equation of motion of a rotating body, Inertial Coefficient, Case of J not parallel to ω, Kinetic energy of rotation and idea of principal axes, Processional motion of a spinning top.

Conservation of Forces: Introduction about conservation and non -conservation Forces, Rectilinear motion under conservation forces, Discussion of potential energy curve and motion of a particle.

Unit-III

Motion under Central Force: Introduction about Central Forces, Motion under central forces, Gravitational interaction, Inertia and gravitational mass, General solution under gravitational Interaction, Kepler's laws, Discussion of trajectories, Cases of elliptical and circular orbits, Rutherford scattering

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Damped harmonic oscillations: Introduction about oscillation in a potential well, Damped force and motion under damping, Damped Simple Harmonic Oscillator, Power dissipation, Anharmonic Oscillator and simple pendulum as an example

Unit –IV

Driven Harmonic oscillations: Driven Harmonic oscillator with damping, Frequency response, Phase relation, Quality factor, Resonance, Series and parallel of LCR circuit, Electromechanical system-Ballistic Galvanometer.

Coupled Oscillations: Equation of motion of two coupled simple harmonic oscillators, Normal modes, motion in mixed modes, transient behaviour, Dynamics of a number of oscillators with neighbour interactions.

Reference Books:

1. Mechanics: Berkeley Physics Course Vol-I, Charles Kittel
2. Mechanics: H S Hans and S P Puri, Tata McGraw Hill
3. The Physics of Waves and Oscillations, N K Bajaj, Tata McGraw Hill
4. Analytical Mechanics: L N Hand, J D Finch (Cambridge University Press)

Paper – II (ELECTROMAGNETISM)

Work load: Two hours lecture per week. Examination Duration: Three Hours

Note:- Total Five questions to be attempted. First question will consist of eight short answer type questions and is compulsory. Four questions will be from four units, one from each unit with internal choice. 40% weightage will be given to problems and numerical. The candidates will be required to attempt all the five questions. All five questions have equal weightage (each question is of 10 marks).

Unit –I

Scalar and Vector Field: Concept of field ,Scalar and vector fields, Gradient of scalar field, Physical significance and formalism of gradient, Divergence and curl of vector field in Cartesian coordinates system, Problems based on Divergence and curl operators

Concept of solid angle, Gauss divergence and Stoke's theorem, Gauss law from inverse square law. Differential form of Gauss law

Unit-II

Field of stationary and moving charges: Potential energy of system of (i) Discrete N-charges (ii) Continuous charge distributions. Energy required to build a uniformly charged sphere, classical radius of electron, Electric field due to short electric dipole, Interaction of electric dipole with external Uniform and non-uniform electric field, Potential due to a uniformly charged spherical shell.

Poisson's and Laplace equations in Cartesian co-ordinates and their applications to solve the problems of electrostatics,

Invariance of Charge, Gaussian and SI units and their inter conversions, Electric field measured in moving frames, Electric field of a point charge moving with constant velocity.

Unit-III

Electric field in matter: Multipole expansion, definition of moments of charge distribution, Dielectrics, Induced dipole moments, polar and non-polar molecules, Free and bound charges, Polarization, Atomic polarizability, electric displacement vector, electric susceptibility, dielectric constant relation between them.

Electric potential and electric field due to uniformly polarized sphere (i) outside the sphere (ii) at the surface of the sphere (ii) inside the sphere, Electric fields due to a dielectric sphere placed in a uniform electric field (a) outside sphere (b) inside surface, Electric field due to a charge placed in dielectric medium and Gauss law, Clausius-Mossoti relation in dielectrics.

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Unit–IV

Magneto statics and Magnetic field in a matter: Lorentz force, properties of magnetic field, Ampere's law, Field due to a current carrying solid conducting cylinder(a) Outside(b) At the surface and (c) Inside the cylinder, Ampere's law in different form, Introduction of magnetic vector potential, Possion's equation for vector potential, Deduction of Bio Savart's law using Magnetic vector potential , Differential form of Ampere's law

Atomic magnet, Gyromagnetic ratio, Bohr Magneton, Larmour frequency, induced magnetic moment and diamagnetism, spin magnetic moment, Para and Ferro magnetism, Intensity of magnetization, Magnetic permeability and susceptibility, free and bound current densities, Magnetic field due to a uniformly magnetized material and non-uniform magnetized material.

Reference Books:

1. Electricity and Mangnetism, A S Mahajan and Abbas A Rangwalam Tata McGraw Hill
2. Introduction to Electrodynamics, David J Griffith, Prentice Hass
3. Berkley Physics Course – Vol II
4. Fundamental University Physics Vol II, Fields and Wave, M Alonso and E J Finn, Addison Wesley Publishing Company.

Paper – III (OPTICS)

Work load: Two hours lecture per week. Examination Duration: Three Hours

Note:- Total Five questions to be attempted. First question will consist of eight short answer type questions and is compulsory. Four questions will be from four units, one from each unit with internal choice. 40% weightage will be given to problems and numerical. The candidates will be required to attempt all the five questions. All five questions have equal weightage (each question is of 10 marks).

Unit-I

Interference: Concept of spatial and temporal coherence, Coherence length, coherence time, Propagation of wave front, Huygens principal of Secondary wavelets, Young double slit experiment, types of interference, interference by division of wave fronts, Fresnel's Bi-prism, Measurement of wavelength and thickness of thin transparent sheet. Interference by division of amplitude: Interference in thin film of constant thickness in transmitted in reflected waves, Interference produced by wedge shaped film, Newton's ring, Determination of wavelength and refractive index by Newton's ring , Fringes of equal inclination (Haidinger fringes) and equal thickness(Fizeau fringes), Michelson's Interferometer, shape of fringes, Measurement of wavelength, difference between two spectral lines and thickness of a thin transparent sheet.

Unit II

Diffraction: Fresnel's diffraction, half period zones, Fresnel's diffraction at a circular aperture, straight edge and a rectangular slit, Zone Plate, multiple foci of Zone plate, comparison between Zone plate and convex lens. Fraunhofer diffraction by single slit and a circular aperture, Fraunhofer diffraction by N parallel slits with two slits as a special case, Missing order, Plane diffraction grating and its use in determining wavelength, Dispersion by a grating, Rayleigh's criterion of resolution, Resolving power of a telescope and grating.

Unit –III

Polarization: Plane, circular and elliptically Polarized light, Polarization by reflection, Double refraction and Huygen's explanation of double refraction, Production and deduction of Plane, Circular and

Elliptically polarized light, Quarter and half wave plates, optical activity, Specific rotation Biquartz and half shade Polari meter and their comparison .

(i) **Laser:** Spontaneous and stimulated emission, Einstein's A&B coefficients, Energy density of radiation As a result of stimulated emission and absorption, population inversion, Methods of optical pumping, Energy level schemes, He-Ne, Ruby, CO_2 lasers.

(ii) **Holography:** Basic concept of holography, Principle, theory, Construction and reconstruction of image, Application of holography.

Unit-IV

Wave motion: 1D and 3 D wave equation, Transverse waves in a stretched string, elastic wave in solids, pressure waves in a gas column, spherical waves, Fourier's Theorem and its application to square and saw-tooth waves.

Phase and group velocities, Dispersion of waves, Electromagnetic waves, Energy density of Electromagnetic waves, Electromagnetic waves in a isotropic and dispersive medium, Spectrum of electromagnetic waves

Reference Books:

1. Optics by Brij Lal & Subramanium, S Chand
2. Optics by D P Khandelwal
3. Principles of optics by B K Mathur
4. Introduction to Modern Optics by A K Ghatak
5. An introduction to Modern Optics by G R Fowels
6. Essential of Lasers by Allen

PRACTICALS

Work Load: Four hours laboratory work per week. **Examination Duration : Four Hours**

Minimum Experiments: Total sixteen taking eight from each section.

The colleges are free to set new experiments of equivalent standard. This should be intimated and approved by the Convener, Board of Studies before the start of academic session. It is binding on the college to have experimental set up of at least sixteen experiments listed below (8 from each section. In case number of experiment performed by the students is less than sixteen, his marks shall be scaled down in final examination on pro rate basis. For example, if he has performed fourteen experiments the marks shall be multiplied by fourteen and divided by sixteen. The number of experiments performed shall be verified from practical record. Laboratory examination paper will be set by the external examiner by making pairs of experiments taking one from each section out of sixteen or more experiments available at the center. Different combinations shall be given for different batch.

Marking Scheme:

	For Regular	For Non-Collegiate
Two Experiments	15 marks each	17 marks each
Record	10	-
Viva-voice	10	16

(For Non-collegiate students: Minimum Compulsory Lab training Hours – 21 ~~Hours~~) Days (42 hours)

Section – A

1. To study the variation of power transfer by two different loads by a DC source and to verify maximum power transfer theorem.

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2. To study the variation of charge and current in a RC circuit with a different time constant (using a DC source).
3. To study the behavior of a RC circuit with varying resistance and capacitance using AC mains as a power source and also to determine the impedance and phase relations.
4. To study the rise and decay of current in an LR circuit with a source of constant emf.
5. To study the voltage and current behavior of an LR circuit with an AC power source Also determine power factor, impedance and phase relations.
6. To study the magnetic field along the axis of a current carrying circular coil. Plot the necessary graph and hence find radius of the circular coil.
7. To determine the specific resistance of a material and determine difference between two small resistance using Carey Fosters Bridge.
8. To convert a galvanometer into a ammeter of a given range.
9. To convert a galvanometer into a voltmeter of a given range.
10. To determine the resolving power of a Telescope.
11. To determine the resolving power of a Grating.
12. To determine the dispersive power of a Prism.

Section – B

1. To study the random decay and determine the decay constant using the statistical board.
2. Using compound pendulum study the variation of time period with amplitude in large angle oscillations.
3. To study the damping using compound pendulum.
4. To study the excitation of normal modes and measure frequency splitting using two coupled oscillators.
5. To study the frequency of energy transfer as a function of coupling strength using coupled oscillators.
6. To study the viscous fluid damping of a compound pendulum and determining damping coefficient and Q of the oscillator.
7. To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficient with the assistance of a conducting lamina.
8. To find J by Callender and Barn's Method.
9. To determine Young's modulus by bending of beam.
10. To determine Y, σ and η by Searle's method.
11. To determine modulus of rigidity of a wire using Maxwell's needle.
12. Study of normal modes of a coupled pendulum system. Study of oscillations in mixed modes and find the period of energy exchange between the two oscillators.
13. To study the specific-rotation of sugar solution by polarimeter.