

TEACHING & EXAMINATION SCHEME
For the Examination – 2015
PHYSICS
B.Sc. Part - I

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
Phy.101	Paper I	Mechanics	2	3	50
Phy.102	Paper II	Optics	2	3	50
Phy.103	Paper III	Electromagnetics	2	3	50
PRACTICAL			6	5	75
			Total :		225

B. SC. PART-1

Paper I: MECHANICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1. :

Frames of Reference: Inertial frames, Galilean transformations, Non-inertial frames, fictitious forces, Displacement, Velocity and acceleration in rotating coordinate systems and their transformations, Coriolis force, Foucault's pendulum, Motion relative to earth.

Centre of Mass, collision of particles in laboratory and C.M. frames.

Trajectory of a particle under inverse central force.

Motion of a system with varying Mass.

UNIT-2:

Special Theory of Relativity: Invariance of c . Michelson-Morley Experiment, Lorentz transformations, Addition of velocities, Time dilation and length contraction.

Conservation of momentum in collision at relativistic speeds and variation of mass with velocity, relativistic energy, mass-energy equivalence, work and energy, transformation equations for momentum, energy and rate of change of momentum.

UNIT-3:

Oscillations : Qualitative idea of oscillations in an arbitrary potential well, General differential equation for the harmonic motion, Helmholtz resonator, mass on a spring, oscillation of two masses connected by a spring, reduced mass.

Coupled oscillations, normal modes, normal coordinates of two linear coupled oscillators, damped harmonic motion, example of a galvanometer with small damping.

Forced oscillations and resonances, Resonance width and quality factor, LCR circuits and phase relations.

UNIT-4 :

Waves : General differential equation of one dimensional wave motion and its solution. Plane progressive harmonic wave, Differential calculus methods for speed of transverse waves on a uniform string and for that of longitudinal waves in a fluid, energy density and energy transmission in waves.

Superposition of waves, group and phase velocity, non-linear superposition and consequences.

Acoustics : The human ear, musical scale, acoustic impedance of a medium, principle of a sonar system.

Fourier series, Fourier analysis of square and saw-tooth waves.

UNIT-5 :

Rigid Body Dynamics : Equation of motion of a rotating body, Inertial coefficient, case of \vec{j} not parallel to $\vec{\omega}$, kinetic energy of rotation and idea of principal axes, Precessional motion of spinning top.

Elasticity : Young modulus, Bulk modulus and modulus of rigidity, Poisson ratio, relation between elastic constants, Theory of bending of a beam and torsion of a cylinder, experimental determination of Y by loading a beam in the middle and of η by static and dynamic methods, Searle's two bar experiment.

Books recommended :

1. Berkeley : Physics Course, Vol. I, Mechanics, Tata McGraw Hill, New Delhi.
2. Berkeley : Physics Course, Vol. III, Waves and Oscillations, McGraw Hill, New Delhi.
3. A. P. French : Physics of Vibration and Waves.
4. Alonso and Finn : Fundamental University Physics, Vol. I, Mechanics.
5. R. S. Gambhir : Mechanics, CBS Publishers.
6. J.C. Upadhyaya : Mechanics, Ram Prasad & Sons, Agra.

PAPER II : OPTICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

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Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1 :

Geometrical Optics : Axial, Lateral and angular magnifications and their inter-relationship; Abbe's Sine condition for spherical surfaces; Aplanatic points for a spherical refracting surface, Abbe's oil immersion objective.

Focal length of two thin lenses separated by a distance, Cardinal points of a co-axial lens system, properties of cardinal points; construction of image using cardinal points; Newton's formula and other relations for a lens system using cardinal points, Ramsden's and Huygen's eye pieces, their cardinal points, and relative merits.

Spherical aberration in lenses and methods to minimize it.

Chromatic aberration in lenses; Achromatism for two thin lenses in contact and separated by a distance.

UNIT-2 :

Interference : Temporal and spatial coherence, coherence length, effect of size of slit and purity of a spectral line.

Division of Amplitude-Interference exhibited by thin film, Production of colours in thin films, Wedge-shaped film. Newton's rings and

determination of wavelength and refractive index of a liquid by Newton's rings.

Michelson Interferometer : Measurement of wavelength, difference between two close wavelengths and thickness of a thin plate.

Fabry-Perot interferometer, Intensity Distribution, Co-efficient of sharpness and half width, measurement of wavelength and resolution of spectral lines of a close doublet.

UNIT-3 :

Lasers and Holography : Spontaneous and stimulated emission, Einstein's A & B coefficients, population inversion, laser as source of coherent radiation, Basic principles of He-Ne Laser, Basic concepts, concepts of holography.

Diffraction : Fresnel's class of diffractions, Cornu's spiral (non-mathematical) Zone Plate; Phase reversal Plate; Cylindrical wave front and its effect at an external point and geometrical construction, diffraction at a straight edge; thin wire; rectangular slit and circular aperture.

UNIT-4 :

Fraunhofer class of diffraction: Amplitude and phase due to a number of SH Motions acting on a particle simultaneously, Diffraction at two slits and intensity distribution, Diffraction at N slits.

Plane Transmission Grating: Theory and formation of spectra, width of principal maxima; absent spectra, overlapping of spectral lines; number of spectra; measurement of wave-length of light; Dispersive Concave Reflection grating; Rowland Mounting; Resolving Power of an instrument, Rayleigh's criterion, Resolving Power of a Prism, Telescope, Microscope and plane transmission grating.

UNIT-5 :

Polarization: Double refraction, production of plane polarized light by double refraction, Nicol Prism, Double refraction in uniaxial crystals, Huygen's explanation of Double Refraction, Plane, circular and elliptically polarized light, Half-wave and quarter-wave plates; production and detection of plane, circularly and elliptically polarized light by Nicol Prism and Quarter-wave plate.

Rotatory Polarization, Fresnel's explanation, specific rotation, half shade and Biquartz Polarimeter, determination of specific rotation and strength of sugar solution.

Books suggested :

1. Jenkins & White : Optics, McGraw Hill.
2. Ghatak A.K. : Optics, Tata McGraw Hill.

3. Khandelwal D.P. : Optics and Atomic Physics, Shivalal Agarwal & Co.
4. Subramanayam & Brijlal : A text book of optics, S.Chand New Delhi.

PAPER III: ELECTROMAGNETICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

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Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1 :

Vector Fields: Scalar and Vector fields, gradient of a scalar field, divergence of vector field and their physical significance, curl of vector field, line integral of vector field, surface integral and flux of a vector field. Gauss law, its integral and differential form, statement and explanation of Gauss theorem and Stokes theorem.

UNIT-2 :

Electrostatics : Potential and field of an arbitrary charge distribution, concept of multi-poles, Potential & field due to a dipole and quadrupole, torque on a dipole in an electric field. Electrostatic energy of a uniformly charged sphere. Classical radius of an electron.

Electric field in matter : Atomic and molecular dipoles, polarizability, permanent dipole moment, Dielectrics, polarization Vector, capacity of parallel plate condenser with partially or completely filled dielectrics, electric displacement and Gauss Law in general form, electrostatic energy of a charge distribution in dielectrics. Lorentz local field and Clausius-Mossotti equation.

UNIT-3 :

Electrostatic fields: Conductors in an electric field, boundary condition for potential, boundary conditions for electrostatic field at electric surface, uniqueness theorem, method of images and its application for

system of point charge near a grounded conducting plane. Poisson's and Laplace equation in Cartesian, cylindrical and spherical polar coordinates (without derivation).

Solution of Laplace equation in Cartesian coordinates, potential at a point inside a rectangular box.

UNIT-4 :

Magnetics: Biot-Savart law, Ampere circuital law in integral and differential forms, divergence of B field, Force on a current carrying wire and torque on a current carrying loop in magnetic field.

Magnetic field in matter: Magnetization Vector, uniform magnetization and surface current, non-uniform magnetization, B,M,H Vectors and their inter-relations, Bohr magneton, orbital magnetic moment and angular momentum, Electron Spin and Magnetic moment, Magnetic Susceptibility.

UNIT-5 :

Electromagnetic Induction, Faraday's laws of Electromagnetic induction, its integral and differential form; Lenz's law; Self and mutual inductance, measurement of self inductance by Rayleigh method; Energy stored in magnetic field.

Transient response: Charge and discharge of condenser through resistance, determination of high resistance by leakage, growth and decay of current in LR circuit; A. C. Circuits, use of j operator in alternating current circuits. LCR circuit in series and in parallel (A.C.), phase diagram, Resonance and Q factor, Sharpness of resonance.

Books suggested:

1. Berkeley : Physics Course, Vol. II : Electricity and Magnetism, Tata McGraw Hill.
2. Spiegel, M.R. : Vector Analysis, Schaum's Outline Series, McGraw Hill.
3. Laud, B.B. : Electro-magnetics, Wiley Eastern.
4. Matveev, A.N. : Electricity and Magnetism, Mir Publishers, Moscow.
5. Griffiths : Introduction to Electrodynamics, PHI.

EXPERIMENTS FOR PRACTICAL WORK

Note : Any 16 experiments to be performed by all the students out of following list.

1. Study of bending of a beam and determination of Young's modulus.
2. Modulus of rigidity by statical and dynamical method.
3. Elastic constants by Searle's method.
4. Nodal slide, determination of cardinal points of a combination of two lenses.
5. Formation of spectrum, prism spectrometer and determination of dispersive power of the material of a prism.
6. Wavelength of light by Newton's rings.
7. Wavelength of light by plane transmission grating.
8. Wavelength of light by biprism.
9. Specific rotation by polarimeter.
10. Resolving power of telescope.
11. To determine the Poisson's ratio of a rubber tube.
12. Study of temperature variation of surface tension by Jagger's method.
13. Resolving power of a plane transmission grating.
14. To determine the polarizing angle for the glass prism surface and to determine the refractive index of material of prism using Brewster's law.
15. Low resistance by Carey Foster Bridge.
16. Variation of magnetic field along the axis of circular Coil.
17. Study of an RL Circuit for Phase relations.
18. Study of rise and decay in CR Circuit.
19. Study of electro-magnetic function and verification of Faraday's Laws.
20. To study the excitation of normal modes and measure frequency splitting using two coupled oscillator.
21. To study the viscous fluid damping of a compound pendulum and to determine the damping coefficient and Q of the Oscillator.