

S. S. Jain Subodh PG (Autonomous) College, Jaipur
Department of Physics
Bachelor of Science (B.Sc. Honors)
Subject – Physics

Examination Scheme:

Semester - I		
Paper	Nomenclature of paper	Max. Marks
PAPER -I	MECHANICS – I	75 Marks
PAPER – II	ELECTROMAGNETISM – I	75 Marks
PAPER – III	OSCILLATIONS AND WAVES –I	75Marks
PAPER – IV	ELECTRICAL AND DIGITAL ELECTRONICS -I	75Marks
Physics Practical – I		150 Marks
Semester - II		
Paper	Nomenclature of paper	Max. Marks
PAPER -I	MECHANICS – II	75 Marks
PAPER – II	ELECTROMAGNETISM – II	75 Marks
PAPER – III	OSCILLATIONS AND WAVES –II	75Marks
PAPER – IV	ELECTRICAL AND DIGITAL ELECTRONICS -II	75Marks
Physics Practical – II		150 Marks

Examination Scheme for each Paper

Part A	7 QUESTIONS (very short answer Questions)	7X 2 MARK EACH	= 14 Marks
Part B	4 QUESTIONS (1 question from each unit with Internal choice)	4X10 MARK EACH	= 40 Marks
	Total of End semester exam (duration of exam 3 hours)		= 54 Marks
	Internal assessment		= 21 Marks
	Maximum Marks (Each theory paper)		= 75Marks
	Max. Practical Marks		= 150 Marks
			(Internal Marks 60+ External marks 90)

Total of Theory Papers : 4 X 75 Marks Each = 300 Marks (Min. Pass Marks 40%)

Total of Practical Marks = 150 Marks

Grand Total of Subject per Semester = 450 Marks

Note:- Syllabus for Subsidiary Subject (Chemistry/ Mathematics) is same as the syllabus for B.Sc. (Pass Course).

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Semester - I

PAPER I: MECHANICS – I

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT-I Physical Laws and Frames of Reference:

Inertial and non-inertial frames, examples. Transformation of displacement, velocity and acceleration between different frames of reference involving translation. Galilean transformation and invariance of Newton's law. Non-inertial frames, fictitious or pseudo forces, Transformation of displacement, velocity and acceleration between rotating co-ordinate systems, centrifugal acceleration, Coriolis force and its applications, Motion relative to earth. Foucault's pendulum

UNIT-II Special Theory of Relativity:

Postulates of special theory of relativity. Lorentz transformations, Addition of velocities and acceleration, Time dilation and length contraction. Variation of mass with velocity, Relativistic energy and mass energy relation.

UNIT-III Conservation Laws:

Conservative forces. Potential energy. Potential energy in gravitational and electrostatic field. Rectilinear motion under conservation forces. Discussion of potential energy curves and motion of a particle. Conservation of angular momentum about an arbitrary point, Precessional motion of Spinning top, Spin precession in constant magnetic field.

UNIT-IV Rigid Body Dynamics:

Equation of motion of a rotating body, inertial coefficients, case of J not parallel to w , kinetic energy of rotation and idea of principle axis. Calculation of moment of inertia of a disc, spherical shell, hollow and solid spheres and cylindrical objects (cylindrical shell, solid cylinder) about their symmetric axis through centre of mass.

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Semester - I

Paper – II ELECTROMAGNETISM – I

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT -I Vector Fields :

Partial derivative. Gradient of a scalar function. Line integral of a vector field. Divergence of a vector field. Divergence in the Cartesian coordinates, Concept of solid angle. Gauss divergence theorem, Gauss law in differential form, Gauss law from inverse square law, physical meaning of divergence of a vector, The Laplacian operator. Poisson's and Laplace equations.

UNIT -II Curl and the Field of Stationary Charge:

Curl of a vector field, curl in Cartesian coordinates, Stoke's theorem, physical meaning of curl. Potential difference and potential function. Potential energy of a system. Application : energy required to build a uniformly charged sphere. Classical radius of the electron, potential and field due to a short dipole, torque and force on a dipole in a Z external field.

UNIT -III The Field of Moving Charge:

Magnetic force, Measurement of charge in motion, Invariance of charge. Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Force on a moving charge, Interaction between a moving charge and other moving charges.

UNIT – IV The Magnetic Field:

The definition of magnetic field, properties of the magnetic field. Ampere's circuital law with applications. Ampere's Law in the differential form. Vector potential. Poisson's equation for vector potential. Field of any current carrying wire and deduction of Bio-Savart law.

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Semester – I

Paper – III OSCILLATIONS AND WAVES –I

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT -I Oscillations:

Oscillations in an arbitrary potential well, Simple harmonic motion, examples-spring mass system, mass on a spring, torsional oscillator, LC circuit, energy of the oscillator,

UNIT -II Damped Oscillator:

Damping of oscillator, viscous and solid friction damping. Power dissipation. Anharmonic oscillator, simple pendulum as an example.

UNIT -III Driven Oscillator:

Driven harmonic oscillator with viscous damping. Frequency response, phase relations. Quality factor, Resonance. Introduction of j operator concept in Electrical oscillations, series and parallel LCR circuit. Electro-mechanical system-Ballistic Galvanometer Effect of damping.

UNIT – IV Coupled Oscillator:

Equation of motion of two coupled S.H Oscillators. Normal modes, motion in mixed modes. Transient behaviour. Effect of coupling in mechanical systems. Electrically coupled circuits, frequency response. Reflected impedance. Effect of coupling and resistive load.

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Semester – I

Paper IV- Electrical and Digital Electronics-I

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

Unit-I:- Quantization of Charge, Current, Measurement of Electric Field and electric Intensity, Kirchoff's Law, Digital Electronics : Signals: Digital & Analog Signals, Positive & Negative Logics, Basic Digital Circuits and operations: AND, OR, NOT, NAND , NOR, Exclusive OR & Exclusive NOR. Boolean Algebra, De Morgan's Theorem.

UNIT-II:- Number system and codes number system, Binary number system, binary arithmetic, Octal number system, Hexadecimal number system, codes: Straight Binary code, Natural BCD codes, Exces-3 codes, Grey code, Hexadecimal code.

UNIT-III:- Standard forms for logical expression: Sum of products (SOP), Conversion into SOP forms, Products of sum (POS), Conversion into POS forms. Advantage of SOP & POS forms, Standard SOP & POS forms, Minterm & Maxterm, Interrelation between Minterm & Maxterm.

UNIT-IV:- Karnaugh Map, Representation of logical functions, K-map with two, three & four variables: Mapping of standard SOP & POS expressions, Minimization of the expression, Mapping of K- map from truth table, Don't care combination, Quine Mc- Clusky algorithms.

Physics Practical : I

Max. Practical Marks

= 150 Marks

Internal Marks

= 60 Marks

External Practical Exam.

= 90 Marks

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Semester - II

Paper I MECHANICS – II

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT-I Centre of mass frame:

Centre of mass, Two particle System, motion of centre of mass and concept of reduced mass, Conservation of energy and linear momentum, Collision of two particles in one and two dimensions (elastic and inelastic), Analysis of collision in centre of mass frame. Slowing down of neutrons in moderator. System with varying mass. Angular momentum and charged particle scattering by a nucleus as an example.

UNIT-II Motion under central forces :

Motion under central force, Gravitational interaction, Inertial and gravitational mass. General solution under gravitational interaction. Rutherford scattering. Discussion of trajectories. Cases of elliptical and circular orbits. Kepler's laws,

UNIT-III Elasticity-I :

Elasticity, Small deformations, Young's modulus, Bulk modulus and Modulus of rigidity for an isotropic solid, Poisson's ratio, relation between elastic constants. Elastic theorems.

UNIT-IV Elasticity-II :

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.

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Paper – II ELECTROMAGNETISM – II

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT – I Magnetic Fields in Matter :

Electric current due to orbital electron, the field of current loop, Bohr magneton. Orbital gyro magnetic ratio Electron spin and magnetic moment. Magnetic susceptibility, magnetic field caused by magnetized matter. Magnetization current. Free current and the field H.

UNIT –II Electric Field in Matter :

The moment of a charge distribution. Atomic and molecular dipoles. Atomic polarizability. Permanent dipole moment, dielectrics. The Capacitor filled with a dielectric. The potential and field due to a polarized sphere.

UNIT –III Dielectric :

Dielectric.. Dielectric sphere placed in a uniform field. The field of charge in dielectric medium and Gauss's law. The connection between electric susceptibility and atomic polarizability. Polarization in changing field. The bound charge (polarization) current.

UNIT -IV Transient behavior and Maxwell's Equations:

Transient behaviour of an R-C circuit. Electromagnetic Induction and Maxwell's Equations, Faraday's law in differential form. Mutual inductance, Self inductance Transient behaviour of an L-R circuit, the displacement current, Maxwell's equations in differential and integral forms.

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Paper – III OSCILLATIONS AND WAVES –II

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

UNIT -I Lattice dynamics:

Dynamics of a number of oscillators with near-neighbour interactions. Equation of motion for one dimensional mono-atomic and diatomic lattices, acoustic and optical modes, dispersion relations. Concept of group and phase velocities.

UNIT – II Electrical Transmission Line:

Electrical transmission line, propagation velocity, losses, characteristic impedance, standing waves, effect of termination.

UNIT –III Wave Motion:

Wave motion – Elastic waves in a solid rod. Pressure waves in a gas column. Transverse waves in a string, waves in three dimensions, spherical waves, Fourier series and Fourier analysis.

UNIT – IV Electromagnetic Wave:

Plane electromagnetic (EM) wave. Energy and momentum of EM wave. Radiation pressure. Radiation resistance of free space. EM waves in dispersive media (normal case). Spectrum of electromagnetic radiations.

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Paper IV-Electrical & Digital Electronics –II

Duration : 3 hrs.

Max. Marks : 54

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain 10 short answer questions of which 7 have to be answered . Each question will carry two marks .

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 10 marks.

Unit-I:- Semi Conductor and Transistor Characteristics, Field Effect Transistor, Digital Logic Families: **(a)** Bipolar Logic Families, Characteristics of Digital IC's. Register Transistor Logic (RTL), DCTL, DTL, ECL, TTL- Circuits. **(b)** Unipolar Logic Families, MOS-Logic: MOSFET Inverter, MOSFET NAND and NOR Gates, CMOS-Logic: CMOS Inverter, CMOS NAND and NOR Gate.

Unit-II:- Combinational Circuits: Multiplexers, Basic four input one output Multiplexer, IC-74151- 8 to 1 Multiplexer, IC- 74150-16 to 1 Multiplexer,De-Multiplexer-1 to 4 De-Multiplexer, 1 to 8 De-Multiplexer, IC-74154-1 to 16 De- Multiplexer, Decoder: Basic Binary Decoder, 3 to 8 Decoder, IC 74154- 4 to 16 Decoder, BCD to Seven Segment Decoder, Parity generators and Checkers.

Unit-III:- Sequential Circuits(Latch): Flip Flops: Flip Flops, Basic Flip Flops (the latch), R-S Flip Flop, D-type Flip Flop, J-K Flip Flop, T-type Flip Flop, Master Slave J-K Flip Flop, Applications of Flip Flops,.

Unit-IV:- Digital Counters: Introduction, Modulus of Counter, Asynchronous Mod-16 Ripple Counter, Synchronous Mod and Counter, Up/Down Counter, Ring Counter, Left and Right Shift Register Operations, Applications of Digital Counters and Shift Registers.

Physics Practical : II

Max. Practical Marks

= 150 Marks

Internal Marks

= 60 Marks

External Practical Exam.

= 90 Marks