

B.Sc. Multidisciplinary with Physics

1stSemester

MDC-PHYT-111: Physics Fundamentals-I

Course Code		Course Title		Credit	Course Type	Duration of Course	No. of hours per Semester
MDC-PHYT-111		Physics Fundamentals-I		03	MDC 1	One Semester	36
No. of hours per week		Total Marks		Pass Marks		End Semester Examination (50 Marks)	Continuous Comprehensive Assessment (CCA) (25 Marks)
L	T	75		30		Written Exam of 02 hours duration	Based on Midterm Exam, Class Test, Assignments and Attendance. i. Midterm Exams: 10 Marks ii. Assignments & presentations: 10 Marks iii. Attendance: 05 Marks
03	----	End Semester Exam)	Internal Assessment	End Semester Exam	Internal Assessment		
		50	25	18	09		

Note: Pass Marks of each subject: 40% Aggregate and minimum 35% in each individual component (term end exams, practical, IA, etc.) of a subject.

Instructions for Paper Setters and Candidates:

- The question paper will consist of four sections: Section A (compulsory, covering whole syllabus from all the units), Section B from Unit 1, Section C from Unit II and Section D from Unit III.. Examiner will set seven questions in all, question number 1 will be compulsory and two questions from each Unit, i.e., I, II, and III, respectively. Each question (section B, C, and D) will carry 12 marks. Question Number 1 (Section A, 14 marks) will consist of ten (10) sub-short answer type questions carrying 02 (two) marks each and candidate has to attempt any seven (7) questions. Each Question must include at least 20% numerical problems.
- Candidate will have to attempt four questions in all, i.e., selecting one question from each sections B, C & D. From the Compulsory section A candidate has to attempt any seven (7) out of ten (10) questions. The duration of the examination will be 2 hours.

Aims:

- To acquire knowledge and understanding of the terms, facts, concepts, definitions, laws, principles and processes of Physics.
- To develop skills in the practical aspects of handling apparatus, recording observations, and

drawing diagrams, graphs, etc.

3. To develop instrumental, communication, deductive and problem-solving skills.
4. To discover that there is a living and growing physics relevant to the modern age in which we live.

Unit I: Matter in Nature

Matter : Definition of matter; Particulate Nature of Matter; States of Matter: solid, liquid and gas and their characteristics; change of state- melting (absorption of heat), freezing, evaporation (cooling by evaporation), condensation, sublimation.

Matter Around Us: Elements, compounds and mixtures. Heterogeneous and homogenous mixtures, colloids and suspensions. Physical and chemical changes (excluding separating the components of a mixture); Pure and Impure substances.

Structure of atom: Composition and size of nucleus; Sub-atomic particles: Electrons, protons and neutrons, Models of atom: Thomson's model and its limitations, Rutherford's model and its limitations, Bohr model and its limitations, Valency, Atomic Number and Mass Number, Isotopes and Isobars.

Atoms and Molecules: Atoms and molecules, Law of Chemical Combination, Atomic and molecular masses. Bonding between atoms; ionic and covalent bonding, polarization; ionic and electronic polarization. Simple numerical problems.

Unit-II Force: Notion and Impact

Force and Newton's laws: Force and Motion, Newton's Laws of Motion, Action and Reaction forces, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration. Elementary idea of conservation of Momentum. Four equations of motions for accelerated bodies (expressions only no derivation). Contact and non-contact forces; Examples of contact forces (frictional force, normal reaction force, tension force as applied through strings and non-contact forces (gravitational, electric and magnetic). General properties of non-contact forces. Inverse square relation, cgs and SI units of force. Concept of work and energy (potential and kinetic). Simple numerical problems. Universal Law of Gravitation- Statement, equation and its importance, applications of the law. Gravity, acceleration due to gravity, free fall. Weight as force of gravity, comparison of mass and weight. Kepler's law of planetary motion. Simple numerical problems.

Unit-III Wave Physics

Sound: Introduction to wave motion. Types of waves, transverse and longitudinal waves, their comparison. Nature of Sound waves. Requirement of a medium for sound waves to travel; propagation and speed in different media. Sound propagation, frequency (ν), wavelength (λ), velocity (v), time period(T), relation $V = \nu\lambda$. (Simple numerical problems) effect of different factors on the speed of sound (density, temperature, humidity, wind, pressure) ; comparison of speed of sound with speed of light; consequences of the large difference in these speeds in air; thunder and lightning. Difference between ultrasonic, supersonic, infrasonic and subsonic frequencies. (Elementary ideas and simple applications only)

Light: Dual nature of light. Reflection of light, refraction of light and transmission of light. (Idea only). Laws of reflection; experimental verification, uses of plane mirrors. Formation of multiple

images when two plane mirrors are placed parallel to each other.

Brief introduction to spherical mirrors - concave and convex mirrors, center and radius of curvature, pole and principal axis, focus and focal length; path of specific rays [rays parallel to the principal axis, rays passing through the focus, rays through center of curvature, rays parallel to each other, rays through a single point on the focal plane]; location and type of images formed from ray diagram for various positions of a small linear object on the principal axis of concave and convex mirrors. $f = R/2$; Cartesian sign convention and direct numerical problems using the mirror formulae are included. Uses of spherical mirrors.

Heat: Concepts of heat and temperature. Heat as energy, SI unit. Propagation of heat Conduction, convection, and radiation with examples. Good and bad conductor of heat. Celsius, Fahrenheit and Kelvin temperature scales. Relation between different scales of temperature. Measurement of temperature, Mercury Thermometer and pyrometer. Thermal expansion, Linear, superficial and cubical expansion and relation between them (without derivation). Latent heat, specific heat of a material. Thermodynamic State Variables: Macroscopic properties that define a system's state, such as pressure, volume, temperature, and mass. Thermodynamic processes: isothermal, adiabatic, isochoric, and isobaric. Zeroth law of thermodynamics, first and second law of thermodynamics and their limitations.

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Books :

- 1) NCERT Science textbook for Class X, 2022.
- 2) NCERT Physics Part-I & Part-II textbook for Class XI, 2022.
- 3) Nootan ISC Physics Part-I & Part-II for Class XI, Nageen Prakashan, 2023-24.
- 4) ABC Physics for Class XI, S. Dinesh and Company, 2025.
- 5) ICSE, Concise Physics for class IX, 2025.

B.Sc. Multidisciplinary with Physics

2nd Semester

MDC-PHYT-122: Physics Fundamentals-II

Course Code		Course Title		Credit	Course Type	Duration of Course	No. of hours per Semester
MDC-PHYT-122		Physics Fundamentals-II		03	MDC 2	One Semester	36
No. of hours per week		Total Marks		Pass Marks		End Semester Examination (50 Marks)	Continuous Comprehensive Assessment (CCA) (25 Marks)
L	T	75		30		Written Exam of 02 hours duration	Based on Midterm Exam, Class Test, Assignments and Attendance. i. Midterm Exams: 10 Marks ii. Assignments & presentations: 10 Marks iii. Attendance: 05 Marks
03		End Semester Exam)	Internal Assessment	End Semester Exam	Internal Assessment		
		50	25	18	09		

Note: Pass Marks of each subject: 40% Aggregate and minimum 35% in each individual component (term end exams, practical, IA, etc.) of a subject.

Instructions for Paper Setters and Candidates:

- The question paper will consist of four sections: Section A (compulsory, covering whole syllabus from all the units), Section B from Unit 1, Section C from Unit II, Section and D from Unit III.

Examiner will set seven questions in all, question number 1 (section A) will be compulsory and two questions from each Unit, i.e., I, II, and III, respectively. Each question (section B, C, and D) will carry 12 marks. Question Number 1 (Section A, 14 marks) will consist of ten (10) sub-short answer type questions carrying 02 (two) marks each and candidate has to attempt any seven (7) questions. Each Question must include at least 20% numerical problems.

- Candidate will have to attempt four questions in all, i.e., selecting one question from each sections B, C, & D.. From the Compulsory section A candidate has to attempt any five (7) out of ten (10) questions. The duration of the examination will be 2 hours.

Aims:

1. To acquire knowledge and understanding of the terms, facts, concepts, definitions, laws, principles and processes of Physics.
2. To develop skills in practical aspects of handling apparatus, recording observations and in drawing diagrams, graphs, etc.
3. To develop instrumental, communication, deductive and problem-solving skills.
4. To discover that there is a living and growing physics relevant to the modern age in which we live.

Unit 1 Electrostatics

Electric charge: concept of charges, positive and negative charge generation, electrostatic induction, unit of electric charge, fundamental properties (quantization, conservation and invariance of charge, demonstrate with examples). Coulomb's law and its importance. Force between multiple charges, superposition principle and equilibrium of charges. Concept of electric field, intensity of electric field, electric field intensity due to point charge (qualitative expression only), electric lines of force and properties of electric lines of force, electric flux, concept of permittivity. Electric dipole and torque on a dipole in an electric field. Electric potential, potential difference, units of potential, Electro-volt (eV) qualitative understanding, potential gradient, electric field as a gradient of electric potential, equipotential surface and its properties. Conductors, semiconductor and insulators (concept based upon flow of charge). Dielectrics, polar and non-polar dielectrics, polarization behaviour of dielectrics in an electric field, relative permittivity, dielectric strength. Numerical based on formula involved in different physical quantities.

Unit 2 Electrodynamics

Electric current, units of current, mean free path, relaxation time and drift velocity of free electron. Mobility of electron, relation between drift velocity of electron and electric current. Electric resistance, inductor and inductance, and capacitor and capacitance, electrical conductivity and resistivity. Colour code of carbon resistors, Ohm's law, ohmic and non-Ohmic conductors, superconductor. Galvanometer, Ammeter and Volt meter. Concept of magnetic field, Oersted experiment, Biot-savart's Law, rules to determine the direction of current induced magnetic field, magnetic flux, permeability, force on moving charge in a uniform magnetic field (Fleming left hand rule), motion of a charged particle in combined electric and magnetic field, force between two parallel current carrying conductors. Current loop as magnetic dipole, torque on a current-loop in a uniform magnetic field. Direct current (DC) and alternative current. Source of DC: electric cell, electromotive force (E) of electric cell, terminal potential difference(V) internal resistance (r) of a cell. Relation between E, V and r. Cells in series and cells in parallel. Alternating current and voltage developed in a rotating coil in magnetic field. AC circuits: current and voltage in, i) circuit containing resistance only, ii) circuit containing inductor only, and

circuit containing capacitor only. Numerical based on formula involved in different physical quantities.

Unit 3 Electrical and electronic devices

Electromagnetic induction (induced emf), Faradays laws of electromagnetic induction, Lenz's law, concept of induced current and induced charge, method of changing magnetic flux, self-induction, coefficient of self-induction, mutual induction, coefficient of mutual induction, SI units of self and mutual induction, eddy currents and its applications, AC generator (principle, construction and working), DC generator (principle, construction and working), DC motor(principle, construction and working). Transformers : working principle of transformers, step up and step down transformers. Induction coil (principle, construction and working). Numerical based on formula involved in different physical quantities.

Classification of conductor, insulator, and semiconductors with examples, electron and holes in the semiconductor, intrinsic and extrinsic semiconductors. n-type and p-type semiconductors. Formation of p-n junction, depletion layer, forward and reverse biasing of p-n junction, symbol for p-n junction diode and I-V characteristics of p-n junction diode. p-n junction as a half wave and full wave rectifier. Special type of junction diode : LED, Photodiode, Solar-cell, Zener-diode (their applications also). Junction transistor, its input and output characteristics. Logic gates : OR gate, AND gate, NOT gate, NAND gate, NOR gate (symbol, Boolean expression and truth table). Numerical based on formula involved in different physical quantities.

Books :

- 1) NCERT Science textbook for Class X, 2022.
- 2) NCERT Physics Part-I & Part-II textbook for Class XII, 2022.
- 3) Nootan ISC Physics Part-I & Part-II for Class XII, Nageen Prakashan, 2023-24.
- 4) ABC Physics for Class XII, S. Dinesh and Company, 2025.