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Department of Physics

Course Learning Outcomes of Physics in B. Sc (PCM)

Program Level	Program Name	Class	Subject	Paper	Paper Name
U.G.	B.Sc (PCM)	01st Year	Physics	01st	Mechanics, Oscillations and Properties of Matter

Course learning outcome	
CO01	Understand laws of motion and their application to various dynamical situations, and notion of inertial frames. He / she will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
CO02	Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.
CO03	Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.
CO04	Understand the phenomena of collisions and idea about center of mass and laboratory frames and their correlation.
CO05	Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.
CO06	Understand simple principles of fluid flow and the equations governing fluid dynamics.
CO07	Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation.
CO08	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
CO09	Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
CO10	In the laboratory course, the student shall perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.

Broad contents of the course	Skills to be learned
• Fundamental of Dynamics • Collisions • Rotational Dynamics • Elasticity • Fluid Motion • Gravitation and cathode force Motion • Oscillation • Non-inertial Systems	• Learn basics of the kinematics and dynamics linear and rotational motion. • Learn the concepts of elastic in constant of solids and viscosity of fluids. • Develop skills to understand and solve the equations of Newtonian Gravity and central force problem. • Acquire basic knowledge of oscillation.

Program Level	Program Name	Class	Subject	Paper	Paper Name
U.G.	B.Sc (PCM)	01st Year	Physics	02nd	Electricity, Magnetism and Electromagnetic Theory

Course learning outcome	
CO01	Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.
CO02	Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.
CO03	Apply Gauss's law of electrostatics to solve a variety of problems.
CO04	Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.
CO05	Demonstrate a working understanding of capacitors.
CO06	Describe the magnetic field produced by magnetic dipoles and electric currents.
CO07	Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.
CO08	Understand the dielectric properties, magnetic properties of materials and the phenomena of electromagnetic induction.
CO09	Describe how magnetism is produced and list examples where its effects are observed.
CO10	Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.
CO11	Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.
CO12	In the laboratory course the student will get an opportunity to verify various laws in electricity and magnetism such as Lenz's law, Faraday's law and learn about the construction, working of various measuring instruments.
CO13	Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

Broad contents of the course	Skills to be learned
• Electric Field and Electric Potential • Conservative nature of Electrostatic Field • Electrostatic energy of system of charges • Dielectric Properties of Matter • Magnetic Field • Magnetic Properties of Matter • Electromagnetic Induction • Electrical Circuits • Network Theorems • Ballistic Galvanometer	• This course will help in understanding basic concepts of electricity and magnetism and their applications. • Basic course in electrostatics will equips the student with required prerequisites to understand electrodynamics phenomena.

Program Level	Program Name	Class	Subject	Paper	Paper Name
U.G.	B.Sc (PCM)	02nd Year	Physics	01st	Thermodynamics, Kinetic Theory and Statistical Physics

Course learning outcome	
CO 01	Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
CO 02	Learn about Maxwell's thermodynamic relations.
CO 03	Learn the basic aspects of kinetic theory of gases, Maxwell–Boltzmann distribution law, equitation of energies, and mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
CO 04	Learn about the real gas equations, Vander Waal equation of state, and the Joule–Thompson effect.
CO 05	In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, temperature coefficient of resistant, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.

Broad contents of the course:	Skills to be learned:

• Zeroth and First Law of Thermodynamics
• Second Law of Thermodynamics
• Entropy
• Thermodynamic Potentials
• Maxwell's Thermodynamic Relations
• Kinetic Theory of Gases :
  ○ Distribution of Velocities
  ○ Molecular Collisions
  ○ Real Gases
	• This basic course in thermodynamics will enable the student to understand various thermo dynamical concepts, principles.

Program Level	Program Name	Class	Subject	Paper	Paper Name
U.G.	B.Sc (PCM)	02nd Year	Physics	02nd	Waves, Acoustics and Optics

Course learning outcome	
CO 01	Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems.
CO 02	Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.
CO 03	Understand the principle of superposition of waves, so thus describe the formation of standing waves.
CO 04	Use the principles of wave motion and superposition to explain the Physics of polarization, interference and diffraction.
CO 05	Understand the working of selected optical instruments like bi-prism, interferometer, diffraction grating, and holograms.
CO 06	In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Bi-prism etc. Resolving power of optical equipment can be learnt firsthand.
CO 07	The motion of coupled oscillators, study of Lissajous figures and behaviour of transverse, longitudinal waves can be learnt in this laboratory course.
CO 08	Understand the spontaneous and stimulated emission of radiation, optical pumping and population inversion. Three level and four level lasers. Ruby laser and He-Ne laser in details. Basic lasing.
CO 09	Measurement of Planck's constant by more than one method.
CO 10	Verification of the photoelectric effect and determination of the work Function of a metal.
CO 11	Determination of the charge of electron and e/m of electron.
CO 12	Determination of the ionization potential of atoms.
CO 13	Determine the wavelength of the emission lines in the spectrum of Hydrogen atom.

Broad contents of the course:	Skills to be learned:
• Superposition of Two Collinear Harmonic Oscillations • Superposition of Two Perpendicular Harmonic Oscillations • Lissajous figures • Waves Motion – General and Velocity • Superposition of Two Harmonics Waves • Wave Optics • Interference and Michelson's Interferometer • Diffraction • Fraunhofer and Fresnel Diffraction • Introduction to Lasers and Holography	• He / she shall develop an understanding of various aspects of harmonic oscillations and waves specially. (i) Superposition of collinear and perpendicular harmonic oscillations. (ii) Various types of mechanical waves and their superposition. • This course in basics of optics will enable the student to understand various optical phenomena, principles, workings and applications optical instruments. • Learn to apply basic quantum physics to Ruby Laser, He-Ne Laser

Program Level	Program Name	Class	Subject	Paper	Paper Name
U.G.	B.Sc (PCM)	03rd Year	Physics	01st	Relativity, Quantum Mechanics, Atomic Molecular and Nuclear Physics

Course learning outcome	
CO01	Describe special relativistic effects and their effects on the mass and energy of a moving object.
CO02	Appreciate the nuances of Special Theory of Relativity (STR)
CO03	Understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.
CO04	Understand the theory of quantum measurements, wave packets and uncertainty principle.
CO05	Understand the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, time dependent and time independent cases, probability density and the normalization techniques, skill development on problem solving e.g. one dimensional rigid box, tunneling through potential barrier, step potential, rectangular barrier.
CO06	Understanding the properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula.
CO07	Ability to calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay. Neutrinos and its properties and role in theory of beta decay.
CO08	Understand fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.
CO09	Understand various interactions of electromagnetic radiation with matter. Electron positron pair creation.
CO10	Verification of the law of the Radioactive decays and determines the mean life time of a Radioactive Sources, Study the absorption of the electrons from Beta decay. Study of the electron spectrum in Radioactive Beta decays of nuclei.

Broad contents of the course	Skills to be learned
• Special Theory of Relativity • One dimensional potential problem of bound states and scattering. • Elementary introduction of nuclear physics with emphasis on (i) Nuclear Structure (ii) Nuclear Forces (iii) Nuclear Decays (iv) Fission and Fusion	• Learn about inertial and non-inertial systems and essentials of special theory of relativity. • Comprehend the failure of classical physics and need for quantum physics. • Grasp the basic foundation of various experiments establishing the quantum physics by doing the experiments in laboratory and interpreting them. • Formulate the basic theoretical problems in one, two and three dimensional physics and solve them.

Program Level	Program Name	Class	Subject	Paper	Paper Name
U.G.	B.Sc (PCM)	03rd Year	Physics	02nd	Solid State Physics, Solid State Devices and Electronics

Course learning outcome	
CO01	A brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.
CO02	Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.
CO03	At knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.
CO04	Secured an understanding about the dielectric and ferroelectric properties of materials.
CO05	Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.
CO06	Understand the basic idea about superconductors and their classifications.
CO07	To carry out experiments based on the theory that they have learned to measure the magnetic susceptibility, dielectric constant, trace hysteresis loop. They will also employ to four probe methods to measure electrical conductivity and the hall set up to determine the hall coefficient of a semiconductor.

Broad contents of the course:	Skills to be learned:
• Crystalline and amorphous substances, lattice, unit cell, miller indices, reciprocal lattice. Brillouin zones and diffraction of X-rays by crystalline materials. • Lattice vibrations and phonons • Different types of magnetism • Dielectric and ferroelectric materials. • Band theory of solids • Insulators, conductors and semiconductors. • Superconductors and their classifications.	• Learn basics of crystal structure and physics of lattice dynamics. • Learn the physics of different types of material like magnetic materials, dielectric materials, metals and their properties. • Understand the physics of insulators, semiconductor and conductors with special emphasis on the elementary band theory of semiconductors. • Comprehend the basic theory of superconductors. Type I and II superconductors, their properties and physical concept of BCS theory.

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