DEPARTMENT OF PHYSICS
C. M. Dubey Post Graduate College, Bilaspur (C.G.)
2015-16

Learning Outcomes in B.Sc. (PCM/PEM/PCsM) Programme (with Physics):

Programme	Branch		
B.Sc.	Mathematics Group (MG)		
B.Sc.	MG	Science Subjects	Acronym of Option
	Option 1	Physics, Chemistry, Mathematics	PCM
	Option 2	Physics, Electronics, Mathematics	PEM
	Option 3	Physics, Computer Science, Mathematics	PCsM

Course Code Numbering:

Class	Paper No.	Code	Paper Name
B.Sc. Part-1	Paper- I	049-05-I	MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER
	Paper- II	049-05-II	ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY
B.Sc. Part-2	Paper- I	005-05-I	THERMODYNAMICS KINETIC THORY AND STATISTICAL MECHANICS
	Paper- II	005-05-II	WAVES, ACCOUSTICS AND OPTICS
B.Sc. Part-3	Paper- I	006-05-I	RELATIVITY, QUANTUM MECHANICS, ATOMIC MOLECULAR AND NUCLEAR PHYSICS
	Paper- II	006-05-II	SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

- **PROGRAMME OUTCOMES (POs):**

The student who will be completing graduation with the Degree B.Sc. (PCM), B.Sc. (PEM), B.Sc. (PCsM) should be able to

PO1. Acquire a systematic conceptual understanding of the academic field of Physics, its different learning areas, and applications in fundamental Physics like Mechanics, Electromagnetism, Thermodynamics, Waves and Optics, Nuclear Physics, Condensed matter Physics, Atomic and Molecular Physics.

PO2. Obtain professional competencies in the subject area of physics leading to a career in research, teaching and government service.

PO3. Possess Specialized skills in the emerging areas of Physics.

PO4. Theoretical skills for solving problems in Physics.

PO5. Execute experiments in Physics and corelate the data with the theory.

PO6. Expertise in the language of Physics and communication skills

PO7. Work in group to carry out a specific task.

- **PROGRAMME SPECIFIC OUTCOMES (PSOs)**:

PSO1. Understand the core concept of Physics subjects.

PSO 2. Acquire analytical and logical skill for higher Education.

PSO 3. Excel in Experimental and Theoretical Physics.

PSO 4. Trained to take up jobs in allied fields.

PSO 5. Confident to take up competitive exams.

- **COURSE OUTCOMES (COs):**

B.Sc. Part-1

Paper-I: MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

EXAM CODE: 049, SUBJECT CODE: 05

- **Broad contents of the course:**

1. Coordinate systems
2. Frames of reference
3. Motion under central force
4. Centre of mass system
5. Rigid body and Rotational Motion
6. Oscillations
7. Motion of charged particles in electric and magnetic fields
8. Elasticity
9. Kinematics of moving fluids

❖ Course learning outcome:

After going through the course, the student should be able to

CO1. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.

CO2. Explain the conservation of energy, momentum, angular momentum and apply them to basic problems.

CO3. Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.

CO4. Apply Kepler's law to describe the motion of planets and satellite in circular orbit.

CO5. Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

CO6. 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.

CO7. Analyze the strength of the solid materials of different size.

CO8. Differentiate between the streamline and turbulent flow of liquids and reason out the effects of liquids while flowing.

CO9. Compare the viscosity and interfacial surface tension between the liquids.

CO10. Understand the effect of gravitation on objects and understand the principle of rocket.

CO11. In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, vernier callipers, Travelling microscope) student shall embark on verifying various principles learnt in theory. Measuring 'g' using Bar Pendulum, and measuring elastic constants of materials, viscous properties of liquids etc.

B.Sc. Part-I

Paper-II: ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

EXAM CODE: 005, SUBJECT CODE: 05

❖ Broad contents of the course:

1.Vector Analysis

2. Electrostatics

3. Magnetism

4. Electromagnetic Induction

5. Maxwell's Equation and EM Wave propagation.

❖ Course learning outcome:

After going through the course, the student should be able to

CO1. Demonstrate 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.

CO2. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.

CO3. Apply Gauss's law of electrostatics to solve a variety of problems.

CO4. Learn knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.

CO5. Demonstrate a working understanding of capacitors.

CO6. Describe the magnetic field produced by magnetic dipoles and electric currents.

CO7. Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.

CO8. Describe how magnetism is produced and list examples where its effects are observed.

CO9. 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.

CO10. Apply various network theorems such as Superposition Theorem, Thevenin Theorem, Norton Theorem, Reciprocity Theorem, Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis.

CO11. In the laboratory course the student will get an opportunity to verify the above outcomes.

B.Sc. Part-II

Paper-I THERMODYNAMICS KINETIC THORY AND STATISTICAL MECHANICS

EXAM CODE: 005, SUBJECT CODE: 05

❖ Broad contents of the course:

1.Laws of Thermodynamics

2. Thermodynamic Potentials

3. Kinetic Theory of Gases

4. Theory of Radiation

5. Introduction to Statistical Mechanics

❖ Course learning outcomes:

CO1. Learn 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. They are also expected to learn Maxwell's thermodynamic relations.

CO2. Know the fundamentals of the kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion, and Brownian motion.

CO3. Have a knowledge of the real gas equations, Van der Waal equation of state, the Joule-Thompson effect.

CO4. Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.

CO5. Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics

CO6. In the laboratory, the students are expected to perform the following experiments:

(i) Measurement of Planck's constant using black body radiation.

(ii) To determine Stefan's Constant.

B.Sc. Part-II

Paper-II WAVES, ACCOUSTICS AND OPTICS

EXAM CODE: 005, SUBJECT CODE: 05

❖ Broad contents of the course:

1. Waves in media
2. Acoustics
3. Aberration
4. Optical Instruments
5. Wave Optics
6. Interference
7. Michelson's Interferometer
8. Diffraction
9. Fraunhofer Diffraction
10. Fresnel Diffraction
11. Polarization

❖ Course learning outcomes:

This course will enable the student to

CO1. Recognize and use a mathematical oscillator equation and wave equation and derive these equations for certain systems.

CO2. Apply basic knowledge of principles and theories about the behavior of light and the physical environment to conduct experiments.

CO3. Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

CO4. Use the principles of wave motion and superposition to explain the Physics of polarization, interference, and diffraction.

CO5. Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.

CO6. 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 Ring experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt firsthand.

B.Sc. Part-III

Paper-I: RELATIVITY, QUANTUM MECHANICS, ATOMIC, MOLECULAR AND NUCLEAR PHYSICS

EXAM CODE: 006, SUBJECT CODE: 05

❖ Broad contents of the course:

1. Special Theory of Relativity
2. Time dependent Schrodinger equation
3. Time independent Schrodinger equation
4. Quantum Theory of hydrogen-like atoms
5. Spectroscopy
6. General properties of nuclei
7. Nuclear models
8. Radioactive decays
9. Nuclear reactions
10. Detectors for nuclear interaction

❖ Course learning outcomes:

CO1. Demonstrate an understanding of the basic principles of the special theory of relativity.

CO2. Perform basic calculations in relativistic kinematics and dynamics.

CO3. Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.

CO4. Understand the theory of quantum measurements, wave packets and uncertainty principle.

CO5. 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.

CO6. Describe the atomic spectra of one and two valance electron atoms.

CO7. Explain the change in behavior of atoms in external applied electric and magnetic field.

CO8. Explain rotational, vibrational, electronic and Raman spectra of molecules.

CO9. 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. Demonstrate an understanding of the factors affecting the stability of the nucleus.

CO10. 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.

CO11. Understand fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.

B.Sc. Part-III

Paper-II SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

EXAM CODE: 006, SUBJECT CODE: 05

❖ Broad contents of the course:

1. Classification of Solids and Crystal Structure
2. Specific heat of solids, Lattice vibrations and phonons.
4. Free electron model
5. Different types of magnetism
6. Band theory of solids
7. Insulators, conductors, and semiconductors.
8. Physics of Semiconductors
9. Active devices in Electronic circuits
10. Oscillators and Amplifiers.
11. Overview of computer architecture
12. Introduction to C-programming.

❖ Course learning outcomes:

CO1. 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.

CO2. To understand how the macroscopic properties of solid result from their microscopic, atomic scale properties.

CO3. To learn the thermal, electrical, magnetic properties of solid in terms of the electronic structures.

CO4. To apply the concepts of lattice vibrations, electrons in solid to metals, semiconductor, and insulators.

CO5. To discuss the basic idea of doping, p-n junction diode and V-I characteristics.

CO6. To illustrate the various biasing circuits of a transistor.

CO7. Design simple oscillator circuits applying the concepts of feedback.

CO8. To develop C-program using the basic building blocks such as arrays, loops etc.