GDC Memorial College

Bahal (Bhiwani) – 127028

NAAC Accredited Grade "B" (Second Cycle) and recognized under sections 2(f) & 12B of the UGC Act, 1956
Affiliated to Ch. Bansi Lal University, Bhiwani

Department of Physics

M.Sc. Physics (2 Years Programme)

Name of Programme: M.Sc. Physics **Session:** 2025-26

Programme Learning Outcomes (PLOs) for PG Programmes (1st Sem) as per NEP 2020:
After the completion of Master degree in Physics the student will be able to:

PLO-1: Knowledge and Understanding
Demonstrate the fundamental and advanced knowledge of the subject and understanding of recent developments and issues, including methods and techniques, related to the Physics.

PLO-2: General Skills
Acquire the general skills required for performing and accomplishing the tasks as expected to be done by a skilled professional in the fields of Physics.

PLO-3: Technical/Professional Skills
Demonstrate the learning of advanced cognitive technical/professional skills required for completing the specialized tasks related to the profession and for conducting and analyzing the relevant research tasks indifferent domains of the Physics.

PLO-4: Communication Skills

Effectively communicate the attained skills of the Physics in well-structured and productive manner to the society at large.

PLO-5: Application of Knowledge and Skills

Apply the acquired knowledge and skills to the problems in the subject area, and to identify and analyze the issues where the attained knowledge and skills can be applied by carrying out research investigations to formulate evidence based solutions to complex and unpredictable problems associated with the field of Physics or otherwise.

PLO-6: Critical thinking and Research Aptitude

Attain the capability of critical thinking in intra/inter-disciplinary areas of the Physics enabling to formulate, synthesize, and articulate issues for designing of research proposals, testing hypotheses, and drawing inferences based on the analysis.

PLO-7: Traditional knowledge, Values and Ethics

Demonstrate awareness of traditional astronomical tools and methodologies and compare them with modern instruments. Understand the historical, cultural, and philosophical foundations of Indian science and its global relevance.

PLO-8: Capabilities/qualities and Mindset

To exercise personal responsibility for the outputs of own work as well as of group/team and for managing complex and challenging work(s) that requires new/strategic approaches.

PLO-9: Employability and job ready Skills

Attain the knowledge and skills required for increasing employment potential, adapting to the future work and responding to the rapidly changing demands of the mployers/industry/society with time.

M. Sc. (Physics) 1st Sem.

Name of Course: **Mathematical Physics**

Course Code: 25PN-PHY 101

Course Outcomes (CLOs) for **Mathematical Physics**

Proposed CLOs for Mathematical Physics (CBLU)

After completing this course, students will be able to:

1. **CLO 101.1:** Explain the structure Understand basics of group theory, preparation of group multiplication tables and construction of character table of symmetry groups.

2. **CLO 101.2:** Solve Find the Fourier series expansion, Fourier integrals, Fourier and Laplace transforms of functions and derivatives.

1. **CLO 101.3:** Obtain explicit expressions of Hermite, Laguerre, Bessel and Legendre polynomials and to establish their recurrence relations and other properties.

1. **CLO 101.4:** Derive Cauchy integral theorem, Cauchy integral formula, Taylor and Laurent series expansion of functions of complex variable and to evaluate some typical definite integral using the method of contour integration.

Name of Course: **Classical Mechanics**
Course Code: 25PN-PHY 102

Proposed CLOs for Classical Mechanics (CBLU)

After completing this course, students will be able to:

1. **CLO1**: Demonstrate a basic and advanced knowledge of Lagrangian and Hamiltonian Formulations and solve related problems Identify coordinates delist and their importance in Hamiltonian formulation.
2. **CLO2**: Acquire knowledge of canonical Transformation and various generating functions for this transformation. Develop a deep understanding to tackle the problems classical mechanics under oscillations.
3. **CLO3**: Demonstrate the concept of motion of a particle under central force and apply advanced methods to deal with central force problems. Use Hamilton-Jacobi theory for finding the solutions of various Classical systems.

4. **CLO4**: Understand the foundations of nonlinear dynamics in general and chaotic motion and fractals, in particular. Perform stability analysis of cubic anharmonic oscillator and undamped pendulum, and find chaotic trajectories.

Name of Course: **Quantum Mechanics-I**

Course Code: 25PN-PHY 103

Course Learning Outcomes (CLOs)

After successful completion of the course, the student is expected to:

CLO1: After taking this course students will be able to appreciate the beauty of quantum mechanics. They will know all types of representations of operators and ways to apply them in different problems

CLO2: The most important thing students learned from this course was how to solve the hydrogen atom problem by using quantum mechanics

CLO3: Students learned about time independent degenerate and non degenerate perturbations and to apply them in harmonic oscillator.

CLO4: Students got an idea of Pauli spin matrices which are very important in nuclear and particle physics as well as atomic and molecular physics.

Name of Course: **Electronic Devices and Circuits-I**

Course Code: 25PN-PHY 104

Course Learning Outcomes (CLO) for Electronic Devices and Circuits-I of M.Sc.-1st Semester of the college affiliated to CBLU, Bhiwani.

After successfully completing this course, the student should be able to:

1. **CLO1:** Be aware of the general characteristics of important semiconductor materials. Develop a deep understanding of the basic design, operation and characteristics of a pn-junction and a BJT along with knowledge of the basic network theorems and their applications in electronic circuit analysis.
2. **CLO2:** Learn to devise and analyze various transistor amplifier models. Understand the concept of negative feedback and its importance in amplifiers.

3. **CLO 3:** Perform a load-line analysis and design of various biasing schemes in amplifiers. Acquaint with the frequency response of variously coupled amplifiers and sources of noise in electronic devices.
4. **CLO 4:** Gain knowledge of classification, sources of distortions and their estimation, operation and determination of efficiency of power amplifiers. Clearly understand the need of regulation, operation and circuit analysis of different voltage and current regulators.

M. Sc. (Physics) 2nd Sem.

Name of Course: **Nuclear and Particle Physics**
Course Code: 25PN-PHY-201

Course Outcomes (COs)

After successful completion of the course, the student is expected to:

CLO 201.1: Understand the energy loss processes of different energetic particles in a medium and mechanisms of interaction of gamma photon with matter and Learn about the basic properties and characteristics of Nuclear forces, and their mediating particle.

CLO 201.2: Know and learn about various type of detectors used in nuclear physics experiments, unique properties of different detectors and their applications in the field of nuclear physics and Differentiate between different type of nuclear reactions, relevant aspects associated with nuclear reactions and kinematics of such reactions.

CLO 201.3: Describe certain properties associated with nuclei, models governing different aspects of nuclear behaviour and detailed understanding of deuteron problem and understand the phenomenon of radioactive decays of alpha and beta particles, their detailed formalism.

CLO 201.4: Know about different elementary particles, their quark content and quark model and Learn about decay of some elementary particles and laws governing such decays.

Name of Course: **Solid State Physics**

Course Code: 25PN-PHY- 202

Proposed COs for Atomic & Molecular Physics-I (CBLU)

After completing this course, students will be able to:

CO 202.1: Analyze the structure of a crystalline solid in terms of lattice, basis and unit cell, and of a non-crystalline solid on the basis of pair-distribution function and deduce the structure of a crystalline solid from the XRD pattern.

CO 202.2: CLO 202.2: Calculate the dispersion of lattice waves for crystals with mono- and diatomic basis, and acquire an understanding of phonon and use it to determine the lattice heat capacity in the Einstein and Debye models.

CO 202.3: Learn the Bloch's theorem, solve the KP model & one-electron Schrödinger equation for a periodic potential, classify materials into conductors, semiconductors and insulators, and apply the tight binding & Wigner-Seitz methods for calculation of energy bands.

CO 202.4: Grasp main characteristics of superconductors, along with qualitative aspects of the BCS theory, explain flux quantization in a superconducting ring, and the DC& AC Josephson effects.

Name of Course: **Quantum Mechanics - II**
Course Code: 25PN-PHY-203

Proposed COs for Physics of Nano-materials (CBLU)

After completing this course, students will be able to:

CLO 203.1: Formulate perturbation, variational & WKB methods for obtaining approximate solutions of the Schrödinger equation, and comprehend simple physical effects: Zeeman & Stark effects & alpha decay.

CLO 203.2: Apply the time-dependent perturbation theory to deal with atom-em radiation interaction and calculate explicitly the transition probability for induced absorption and emission.

CLO 203.3: Explicate electronic structure of manyelectron atoms in central-field approximation, estimate the central potential using the Thomas-Fermi & Hartree methods, and have an understanding of molecular energy levels.

CLO 203.4: Grasp the basics of quantum scattering theory, learn the partial waves and Green's function methods for deriving scattering cross-sections, and calculate these for finite square well, hard sphere & screened Coulomb potentials.

Name of Course: **Electronic Devices and Circuits-II**

Course Code: 25PN-PHY- 205E

Course Outcomes (CO) for Electronics-I of M.Sc.-3rd Semester of the college affiliated to CBLU, Bhiwani.

After successfully completing this course, the student should be able to:

CLO 204.1: Well acquainted with the basic structures, operations, characteristics and biasing schemes of various field effect transistors. Understand the operations of different multivibrator circuits.

CLO 204.2: Develop a clear understanding of the basics of OPAMPS, its operating modes, internal structure and its vital design parameters. Become familiar with the basic structure, operation, characteristics and important applications of negative resistance devices.

CLO 204.3: Design and describe the operations of various families of logic gates. Simplify involved Boolean expressions with the help of Boolean algebra and K-map.

CLO 204.4: Explain the construction, operation, characteristics and important technological applications of various photonic devices. Explain the construction, operation, characteristics and important technological applications
of different temperature sensitive devices.

Name of Course: **India's contribution to Science Electronic**

Course Code: 25PN-PHYIKS201

CLO 207.1: Understand the development of astronomy in the Indus, Vedic, and Post-Vedic periods.

CLO 207.2: Explain the Indian Yuga system, Moon phases, star and planet movements, and Indian calendar systems.

CLO 207.3: Identify traditional Indian astronomical instruments and their functions.

CLO 207.4: Analyze the contribution of Indian observatories to astronomy.

CLO 207.5: Appreciate the lives and works of eminent Indian scientists and their scientific impact.

CLO 207.6: Evaluate the role of Indian scientific institutions like CSIR,