

Department Of Physics

2.6.1 Course Learning Outcomes (CLOs), Program Learning Outcomes (PLOs), and Program Specific Outcomes (PSOs) CURRICULUM & SYLLABUS



Bachelor of Science (Hons.) Physics

or

**Bachelor of Science (Hons.) Physics with Research/
Academic Projects**

(A 4 Year Undergraduate Degree Program)

Under UGC Framework - 2022 based on NEP – 2020

(w.e.f. Academic Year 2023-24)

**DEPARTMENT OF PHYSICS
FACULTY OF SCIENCE AND HUMANITIES
SRM UNIVERSITY DELHI-NCR, SONEPAT
Plot No.39, Rajiv Gandhi Education City, P.S. Rai,
Sonapat Haryana-131029**

B. Sc. PHYSICS PROGRAM LEARNING OUTCOMES

Graduates from the B. Sc. Physics undergraduate degree program will be able to

- PLO1** Demonstrate a conceptual understanding in the core areas of physics and the supporting mathematics including the range of validity of key concepts.
- PLO2** Translate physical descriptions into mathematical equations, and conversely, explain the physical meaning of mathematical results.
- PLO3** Use computational techniques such as coding at a level necessary to perform statistical analysis and simulations in solving complex problems.
- PLO4** Use basic laboratory equipment effectively in order to conduct measurements and analyze the results including the understanding of error limits.
- PLO5** Communicate the scientific results efficiently, making use of clear and well organized writing and presentation skills, and employ equations and visualization tools as needed.

MATHEMATICAL PHYSICS I	
Course Code: 23PHBS101	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

Course Learning Outcome (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Familiarity with the behaviour of vectors under rotations and scalar products.
- CLO 2.** Demonstrate Gauss' divergence theorem, Green's theorem, and Stokes' theorem to solve practical problems.
- CLO 3.** Apply coordinate transformations to vector calculus operations.
- CLO 4.** Evaluate various forms of special integrals using gamma and beta functions.
- CLO 5.** Analyze the basic concepts of probability and its applications in physics.

MECHANICS & GENERAL PROPERTIES OF MATTER	
Course Code: 23PHBS102	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination: -- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

Course Learning Outcome (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Define Newton's laws of motion and their significance in describing the relationship between force and motion.
- CLO 2.** Able to understand the Galilean transformations and explain their use in relating positions and velocities in different frames.
- CLO 3.** Understand the work done by a force and its relationship with displacement and force direction.
- CLO 4.** Apply Lorentz transformations to describe simultaneity, time dilation and length contraction
- CLO 5.** Well versed with the conservation of mechanical energy and its application in analyzing motion.

MECHANICS & GENERAL PROPERTIES OF MATTER LAB	
Course Code: 23PHBS152	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE
Prerequisite: NIL	

Course Learning Outcome (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

1. Familiarity with graphical presentation techniques of measured data.
2. Get an insight into the principle involved in measuring the various physical parameters.
3. Understand how to measure various physical parameters including rigidity modulus, moment of inertia, coefficient of viscosity, Young's modulus, elastic constants etc.
4. Understands the error estimation.
5. Perform the experiment for various properties of liquid.

MATHEMATICAL PHYSICS II	
Course Code: 23PHBS201	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

Course Learning Outcome (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

1. Equipped with good knowledge of basic methods of single variable calculus and ability to apply the same in physics.
2. Well-versed with the techniques of multi-variable calculus and ability of applying the same in physics.
3. Able to solve differential equation and apply it in physics.
4. Familiar with special functions such as Legendre, Bessel, Hermite and Laguerre functions and capability to use them in physics.
5. Acquire an understanding of error analysis within a dataset.

WAVES & OPTICS	
Course Code: 23PHBS202	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination: -- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: Knowledge on Wave & Oscillations	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Get basic understanding of the core principles underlying wave phenomena.
- CLO 2.** Well-versed with the interference and diffraction effects.
- CLO 3.** Understanding of polarization of light.
- CLO 4.** Knowledge of techniques of polarizing light.
- CLO 5.** Familiarity with the concepts of holography and its applications.

WAVES & OPTICS LAB	
Course Code: 23PHBS252	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Interpret the various methods to perform waves and optics experiments.
- CLO 2.** Describe a comprehensive understanding of the Physics underpinning optical experiments.
- CLO 3.** Illustrate the practical understanding of diverse optical principles through hands-on experimentation
- CLO 4.** Explain with the analysis of results of optical experiments.
- CLO 5.** Design new experiments or variations of existing methods.

MATHEMATICAL PHYSICS III	
Course Code: 23PHBS301	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination: -- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Describe the properties of matrices and understand their relevance in various physics applications.
- CLO 2.** Apply the concept of vector space and comprehend its significance in different areas of physics.
- CLO 3.** Explain the methods of solving second-order partial differential equations using various techniques and illustrate their practical application in physics scenarios.
- CLO 4.** Examine mathematical techniques involving complex variables and their importance in tackling physics problem-solving tasks.
- CLO 5.** Interpret the significance of Fourier transform and Laplace transform in physics, and they will be able to compare their advantages and limitations for specific applications.

COMPUTATIONAL PHYSICS LAB I	
Course Code: 23PHBS351	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of the course, students would be

- CLO 1.** Describe the various techniques utilized in 2D plotting with Gnuplot.
- CLO 2.** Demonstrate an understanding of the concepts of linear and nonlinear fitting and how they are applied in different situations.
- CLO 3.** Employ their knowledge of various data types, arrays, and loops to understand the various aspects of programming.
- CLO 4.** Inspect and assess the advantage of fundamental programming techniques and how they are applied in diverse scenarios.
- CLO 5.** Design new experiments or variations of existing methods.

ELECTRICITY & MAGNETISM	
Course Code: 23PHBS302	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination: -- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Demonstrate knowledge and understanding of Coulomb interaction and the fundamental concepts of electrostatics.
- CLO 2.** Explain the dielectric properties of matter and the significance of these properties in electrical and electronic applications.
- CLO 3.** Describe the principles of magnetic fields and magnetostatics to solve problems and analyze magnetic interactions in various scenarios.
- CLO 4.** Distinguish the behavior of magnetostatics and magnetic fields within different types of matter.
- CLO 5.** Construct a comprehensive understanding of basic circuit theory and demonstrate its application in designing and analyzing electrical circuits.

ELECTRICITY & MAGNETISM LAB	
Course Code: 23PHBS352	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination: -- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Illustrate circuit theorems and demonstrate solving complex electrical circuits.
- CLO 2.** Demonstrate principles to measure parameters in electrostatic experiments along with experimental setup and data analysis.
- CLO 3.** Deduce principles in measuring parameters in magnetism.
- CLO 4.** Evaluate various aspects of electromagnetic induction experiments.
- CLO 5.** Design new experiments or variations of existing methods.

THERMAL PHYSICS	
Course Code: 23PHBS303	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination: -- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Summarize the principles of heat transfer mechanisms and describe the behavior of ideal gases and the kinetic theory of gases.
- CLO 2.** Demonstrate the ability to calculate heat transfer, work done, and efficiency in various thermodynamic processes.
- CLO 3.** Differentiate between reversible and irreversible processes and their impact on efficiency.
- CLO 4.** Critique the concept of absolute zero temperature and the third law of thermodynamics and judge the feasibility of different heat engine cycles and their efficiency.
- CLO 5.** Develop strategies for optimizing the efficiency of heat engines or designing effective heat exchangers.

THERMAL PHYSICS LAB	
Course Code: 23PHBS353	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination: -- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Summarize the theory behind different heat transfer experiments.
- CLO 2.** Demonstrate the ability to set up and operate equipment for heat conduction experiments.
- CLO 3.** Examine the effects of variables like material composition and surface area on heat transfer rates.
- CLO 4.** Judge the significance of experimental findings in relation to real-world applications.
- CLO 5.** Develop setups to demonstrate thermal expansion phenomena and measure coefficients of expansion.

MATHEMATICAL PHYSICS IV	
Course Code: 23PHBS401	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination: -- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge on complex number and differential equations	

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COURSE LEARNING OUTCOMES(CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Perform arithmetic operations and conversions between different representations of complex numbers and apply the Cauchy-Riemann equations to determine the conditions for complex functions to be analytic.
- CLO 2.** Evaluate complex integrals by applying various techniques.
- CLO 3.** Use second-order differential equations to solve real-world problems in engineering and physics.
- CLO 4.** Apply systems of equations to model interconnected phenomena in various fields.
- CLO 5.** Utilize group theory concepts creatively to solve complex problems.

COMPUTATIONAL PHYSICS LAB II	
Course Code: 23PHBS451	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Learn how to write, debug, and optimize code for numerical simulations.
- CLO 2.** Apply numerical methods to solve physics problems that are challenging or impossible to solve analytically.
- CLO 3.** Implement and analyze various ODE solvers, including Euler, Runge-Kutta, and adaptive methods.
- CLO 4.** Interpret and communicate findings through graphs, plots, and visual representations.
- CLO 5.** Design new experiments or variations of existing methods.

ELECTRONICS I	
Course Code: 23PHBS402	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination:-- Marks
L T P : 3 0 0	Course Type: MAJOR
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Summarize the operation of semiconductor devices, including diodes and transistors and describe the functionality of basic analog and digital circuits.
- CLO 2.** Demonstrate the ability to design and analyze simple amplifiers, filters, and logic circuits.
- CLO 3.** Differentiate between various amplifier configurations, feedback topologies, and logic gate families.
- CLO 4.** Critique the trade-offs between different design choices in terms of power consumption, efficiency, and stability.
- CLO 5.** Develop schematics for practical implementation of electronic designs.

ELECTRONICS LAB I	
Course Code: 23PHBS452	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Summarize the characteristics of different amplifier configurations, filters, and oscillators.
- CLO 2.** Demonstrate the ability to measure voltage, current, and impedance using appropriate instruments.
- CLO 3.** Differentiate between different types of amplifiers and their frequency responses.
- CLO 4.** Critique the limitations of components and their impact on circuit functionality.
- CLO 5.** Develop projects that integrate multiple electronic components to achieve specific functionalities.

MODERN PHYSICS	
Course Code: 23PHBS403	Continuous Evaluation: -- Marks
Credits: 3	End Semester Practical Examination:-- Marks
L T P : 3 0 0	Course Type: MAJOR
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After

completion of course, students would be able to:

- CLO 1.** Explain the limitations of classical physics and the onset of quantum effects.
- CLO 2.** Construct the Schrödinger equation and able to solve it.
- CLO 3.** Able to apply quantum mechanical approach to solve simple 1D problem.
- CLO 4.** Analyse the application of Schrödinger equation in three dimension problem.
- CLO 5.** Evaluate the solution of Schrödinger equation in spherical polar coordinates.

MODERN PHYSICS LAB	
Course Code: 23PHBS453	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would able to:

- CLO 1.** Relate the experimental knowledge of various modern physics concepts.
- CLO 2.** Compare various constants including Boltzmann constant, Planck's constant etc
- CLO 3.** Demonstrate the insights of the Physics involved in the experiments
- CLO 4.** Analyse the absorption lines in rotational spectra and photoelectric effect.
- CLO 5.** Assess the error estimation in various experiments

CLASSICAL MECHANICS	
Course Code: 23PHBS501	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Compare the concepts of constraints, Lagrangian and Hamiltonian formulation.
- CLO 2.** Demonstrate the canonical transformation and Poisson's bracket.
- CLO 3.** Analyse the mechanics of rigid bodies.
- CLO 4.** Evaluate the ideas of fluid dynamics.
- CLO 5.** Design the Classical field theory formalism.

ELECTROMAGNETIC THEORY	
Course Code: 23PHBS502	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination:-- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able:

- CLO 1.** Explain the basics of electromagnetic induction.
- CLO 2.** Demonstrate fundamental laws of electromagnetic theory and Maxwell's equations.
- CLO 3.** Compare the EM propagations propagation in free space, dielectric and metals.
- CLO 4.** Formulate the reflections, refraction and polarization of EM waves.
- CLO 5.** Evaluate the polarization of light and various related phenomena.

ELECTROMAGNETIC THEORY LAB	
Course Code: 23PHBS552	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

- CLO 1.** Familiarity with on measurement methods and use of specific instruments to analyze plane polarized light.
- CLO 2.** Get an insight into the principle involved in measuring specific rotation of solutions and wavelength and velocity of ultrasonic waves in a solution.
- CLO 3.** Understand how to measure various optical properties and phenomena using different methods.
- CLO 4.** Well-versed with the various method to determine various constants in radiation laws.
- CLO 5.** Understand to take data reading carefully and estimate of error.

QUANTUM MECHANICS I	
Course Code: 23PHBS503	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: NIL	

COURSE LEARNING OUTCOME (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Compare the wave functions, operators, and their properties to describe and analyse quantum systems.
- CLO 2.** Construct the angular momentum algebra in quantum mechanics.
- CLO 3.** Analyse the hydrogen atom problem and compare to experimental findings.
- CLO 4.** Evaluate the effect of electric and magnetic fields on the solutions of the hydrogen like atoms.
- CLO 5.** Appraise the Schrödinger equation solution for identical particle system and its symmetries.

ELECTRONICS - II	
Course Code: 23PHBS504	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination:-- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge about electronics	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the understanding of semiconductor devices.
- CLO 2.** Familiarize students with data storage device and combinational circuits.
- CLO 3.** Fluent with the understanding of the Field effect transistor and its characteristics.
- CLO 4.** Becomes familiar with the working of operation amplifier and its application
- CLO 5.** Able to understand the principles behind oscillators and signal generators

ELECTRONICS LAB - II	
Course Code: 23PHBS554	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Familiarity with on measurement methods and use of specific instruments to analyze plane polarized light.
- CLO 2.** Get an insight into the principle involved in measuring specific rotation of solutions and wavelength and velocity of ultrasonic waves in a solution.
- CLO 3.** Understand how to measure various optical properties and phenomena using different methods.
- CLO 4.** Well-versed with the various method to determine various constants in radiation laws.
- CLO 5.** Evaluate data reading carefully and estimate error.

CONDENSED MATTER PHYSICS - I	
Course Code: 23PHBS601	Continuous Evaluation: -- Marks
Credits: 3	End Semester Examination:-- Marks
L T P : 3 0 0	Course Type: MAJOR COURSE
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of crystal structure and various structural parameters
- CLO 2.** Familiar with X-ray diffraction methods
- CLO 3.** Well versed with the understanding of crystal bonding, defects and diffusion in solids.
- CLO 4.** Well versed with concepts of lattice vibrations and phonon modes, and theory of specific heat.
- CLO 5.** Familiar with free electron theory and band theory of solids.

CONDENSED MATTER PHYSICS LAB - I	
Course Code: 23PHBS651	Continuous Evaluation: -- Marks
Credits: 1	End Semester Practical Examination:-- Marks
L T P : 0 0 2	Course Type: MAJOR COURSE LAB
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Get Familiar with different methods to estimate magnetic susceptibility of solids.
- CLO 2.** Get an insight into the practical method and principle involved in measuring the various physical parameters of dielectric materials.
- CLO 3.** Understand how to measure energy loss from BH curve loop.
- CLO 4.** Fluent with understanding of handle instruments and measure various conducting properties of semiconductors such as hall coefficient and resistivity.
- CLO 5.** Understand to take data reading carefully and estimate of error.

ELECTRODYNAMICS	
Course Code: 23PHBS602	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge about Electricity and Magnetism	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Get an understanding of covariance laws of classical electrodynamics.
- CLO 2.** Well versed with the different potential and fields acting on the charged particles.
- CLO 3.** Fluent with the knowledge about radiation.
- CLO 4.** Well versed with the knowledge of relativistic electrodynamics.
- CLO 5.** Able to understand the propagation of EM wave in different waveguides.

QUANTUM MECHANICS - II	
Course Code: 23PHBS603	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge of quantum well, harmonic oscillator problems	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Reinforce students' foundational knowledge of quantum mechanics while demonstrating its applicability in diverse physical situations.
- CLO 2.** delve into advanced problem-solving methods for dealing with complex quantum systems that defy exact solutions..
- CLO 3.** Analyse scattering experiments, calculate scattering cross-sections, and understand the quantum mechanical implications of scattering processes.
- CLO 4.** Justify the complexities of quantum mechanical descriptions of atoms and the challenges posed by electron correlations.
- CLO 5.** Evaluate the quantum phenomena in the context of both radiation and the relativistic regime, expanding their understanding of the theory's applicability..

LASER AND NON-LINEAR OPTICS	
Course Code: 23PHBS604	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Able to gain good knowledge about lasing action.
- CLO 2.** Well-versed with the construction and working of different laser systems.
- CLO 3.** Fluent with the principle, working, and construction of different types of laser.
- CLO 4.** Well equipped with the non-linear processes.
- CLO 5.** Able to get an understanding of laser applications in various fields

CONDENSED MATTER PHYSICS II	
Course Code: 23PHBS701	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: CONDENSED MATTER PHYSICS I	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of transport properties of solids.
- CLO 2.** Get an understanding of optical properties of materials.
- CLO 3.** Well-versed with the magnetic properties of solids.
- CLO 4.** Able to gain good knowledge to students abouts superconductivity.
- CLO 5.** Familiarity with the dielectric and ferroelectric properties of solids.

NUCLEAR AND PARTICLE PHYSICS	
Course Code: 23PHBS702	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: Basic understanding of Quantum mechanics.	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be

- CLO 1.** Well-versed with nucleus structure and its fundamental properties.
- CLO 2.** Able to get an understanding of nuclear reactions, radioactive decay.
- CLO 3.** Equipped with construction and working of nuclear energy reactors and thermonuclear reactions.
- CLO 4.** Able to grasp knowledge of energy generation in nuclear fission.
- CLO 5.** Fluent the students with elementary particles, and symmetry groups.

STATISTICAL MECHANICS - I	
Course Code: 23PHBS703	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Relate the basics of mathematical statistics.
- CLO 2.** Describe the understanding of statistics of system of identical particle.
- CLO 3.** Demonstrate various aspects of Bose-Einstein statistics.
- CLO 4.** Formulate the Fermi-Dirac statistics.
- CLO 5.** Evaluate various laws and phenomena of radiation.

ATOMIC AND MOLECULAR PHYSICS	
Course Code: 23PHBS801	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge about atomic and molecular structure of atom.	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Explain the fundamental concepts of atomic and molecular structure, energy levels, and transitions.
- CLO 2.** Identify and describe the types of spectroscopic techniques used to study atomic and molecular systems.
- CLO 3.** Analyze and interpret electronic, vibrational, and rotational spectra to extract relevant information about energy levels and molecular properties
- CLO 4.** Apply selection rules and transition probabilities to predict allowed electronic and vibrational transitions.
- CLO 5.** Compare and contrast the advantages and limitations of various spectroscopic techniques for different types of samples and research objectives.

SEMICONDUCTOR PHYSICS	
Course Code: 23PHBS802	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge about semiconducting materials	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Explain the concept of energy bands and bandgap in semiconductors and describe their significance in electronic behaviour.
- CLO 2.** Differentiate between intrinsic and extrinsic semiconductors and explain the role of dopants in controlling carrier concentrations.
- CLO 3.** Analyse the carrier densities, Fermi levels, and conductivities in both intrinsic and doped semiconductors.
- CLO 4.** Comply the principles of photodetectors and solar cells and their applications in energy conversion.

- CLO 5.** Appraise the importance of semiconductors in modern technology, including integrated circuits, communication devices, and renewable energy systems.

STATSTICAL MECHANICS - II	
Course Code: 23PHBS803	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Type: MAJOR COURSE
Prerequisite: Basic knowledge about thermodynamics	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able:

- CLO 1.** Underline various statistical terms and their relations with thermodynamic quantities.
- CLO 2.** Compare different ensembles and partition function.
- CLO 3.** Demonstrate the quantum statistics of ideal gases.
- CLO 4.** Comply fluctuations and thermodynamic irreversible processes.
- CLO 5.** Evaluate the phase transition and different models.

INTRODUCTION TO ALGEBRA	
Course Code: 23MABS001	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Interdisciplinary course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Identify and develop concept of mapping and relations.
- CLO 2.** Solve the basics problems of set theory.
- CLO 3.** Well versed with different type of matrices.
- CLO 4.** Apply matrix method solving system of equations problems.
- CLO 5.** Solve vector identities.

DIFFERENTIAL CALCULUS	
Course Code: 23MABS002	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Interdisciplinary course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Identify and develop concept of mapping of functions.
- CLO 2.** Solve the limit continuity problems of functions.
- CLO 3.** Apply graphical method for test differentiability of function.
- CLO 4.** Well versed with tangent normal and curvature.
- CLO 5.** Solve problems of polar coordinate and curve tracing of curve.

DIFFERENTIAL EQUATIONS	
Course Code: 23MABS003	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Interdisciplinary course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Identify ordinary differential equations.
- CLO 2.** Solve the linear differential equations by various methods.
- CLO 3.** Well versed with Cauchy-Euler equation.
- CLO 4.** Apply the concept of total differential equations.
- CLO 5.** Identify classification of second order partial differential equations.

STATISTICAL METHODS AND PROBABILITY	
Course Code: 23MABS004	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Interdisciplinary course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Identify and develop knowledge of basics and importance of statistics.
- CLO 2.** Solve the problems based on concept of central tendency.
- CLO 3.** Apply the concept of random experiment, definition of probability.
- CLO 4.** Well versed with Bayes theorem and its applications.
- CLO 5.** Solve problems of concept of discrete random variables.

PHYSICAL CHEMISTRY-I	
Course Code: 23CYBS001	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Interdisciplinary course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Calculate the heat flow into and work done by a system and how that is constrained by the first law of thermodynamics.
- CLO 2.** Explain the behaviour of ideal and real gases.
- CLO 3.** Describe various radioactive decay process, decay kinetics and to measure the radioactivity.
- CLO 4.** Demonstrate the symmetry elements and symmetry operation, lattice parameters using the X-ray diffraction pattern.

ADVANCED ELECTRONICS	
Course Code: 23PHBS001	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Good understanding of the microwave characteristics and its detection techniques.
- CLO 2.** Ability to understand the working, and principle behind LAN, WAN, MAN and topology.
- CLO 3.** Get an understanding of the signal transmission by Amplitude and phase modulations.
- CLO 4.** Able to grasp the knowledge about the working and applications of INTEL 8085 microprocessor architecture.
- CLO 5.** Familiarity with the working and application of LED and diode LASERS.

ASTRONOMY & ASTROPHYSICS	
Course Code: 23PHBS002	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite: Basic knowledge of astronomy and astrophysics	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Demonstrate a thorough comprehension of key fundamental concepts in astronomy and astrophysics.
- CLO 2.** Possess detailed knowledge of the processes involved in star formation and evaluation.
- CLO 3.** Illustrate an understanding of the Sun's characteristics and its various dynamic activities.
- CLO 4.** Describe and analyze the structure, types, formation, and evolutionary pathways of galaxies.
- CLO 5.** Compare and contrast various theories of the universe's origin and evolution, demonstrating a comprehensive understanding.

NANO MATERIALS	
Course Code: 23PHBS003	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with good knowledge on physics at nanoscale.
- CLO 2.** Fluent with characterization of materials.
- CLO 3.** Able to get an understanding of the physics of thin film growth.
- CLO 4.** Well-versed with the vacuum technology and thin film growth.
- CLO 5.** Able to get an understanding of the thin film characterization techniques.

BIOPHYSICS	
Course Code: 23PHBS004	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Outline key terms and concepts related to molecular biophysics, cellular mechanics, and bioenergetics.
- CLO 2.** Demonstrate the ability to calculate forces and energies in biophysical systems using appropriate equations.
- CLO 3.** Differentiate between different biophysical methods and their applications in studying biological systems.
- CLO 4.** Review the limitations and potential artifacts of biophysical techniques and propose solutions for improving accuracy.
- CLO 5.** Develop innovative approaches to address biological questions using biophysical methods.

RADIATION PHYSICS	
Course Code: 23PHBS005	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Infer the biological effects of radiation exposure and the factors influencing dose distribution.
- CLO 2.** Display the ability to use dosimetry techniques to measure and assess radiation levels.
- CLO 3.** Differentiate between different types of radiation detectors and dosimeters and their applications.
- CLO 4.** Examine the safety protocols and regulations for handling radiation sources in various settings.
- CLO 5.** Develop protocols for radiation safety and emergency response procedures.

MEDICAL PHYSICS	
Course Code: 23PHBS006	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Demonstrate familiarity with key concepts in Medical Physics.
- CLO 2.** Apply knowledge and skills in conducting bio-potential measurements.
- CLO 3.** Invent the various new applications of Medical Instrumentation.
- CLO 4.** Demonstrate proficiency in Radio Physics concepts.
- CLO 5.** Apply knowledge to measure blood pressure and volume flow accurately.

ATMOSPHERIC PHYSICS	
Course Code: 23PHBS007	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Illustrate the fundamental of atmospheric science and its various applications.
- CLO 2.** Develop a detailed understanding of microphysics and chemistry of clouds.
- CLO 3.** Identify and describe various atmospheric instruments used for measurements and analysis.
- CLO 4.** Analyze the principles and phenomena related to atmospheric optics.
- CLO 5.** Evaluate the concept of remote sensing and its application the context of Earth's atmospheric.

FIBER OPTICS	
Course Code: 23PHBS008	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with knowledge of the wave guide characteristics and basic structures of optical fibres.
- CLO 2.** Able to understand the principle behind the signal dispersion of the guided mode of optical fiber
- CLO 3.** Well-versed with the principles behind spectroscopic application of optical fibers.
- CLO 4.** Fluent with good knowledge of the optical fiber application
- CLO 5.** Well versed with health-based applications of fiber sensors

SOFT MATTER PHYSICS	
Course Code: 23PHBS009	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge about materials viz. liquid crystals, colloids, polymers etc.
- CLO 2.** Able to understand the different statics involved in polymer materials
- CLO 3.** Get an understanding of the elastic properties of soft materials and fluid dynamics.
- CLO 4.** Well-versed with the various interactions involved in soft matter physics
- CLO 5.** Able to have an understanding about the special nanomaterials.

RENEWABLE ENERGY PHYSICS	
Course Code: 23PHBS010	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would

- CLO 1.** Elucidate the environmental and economic benefits of utilizing renewable energy sources.
- CLO 2.** Demonstrate the ability to analyze data and predict energy generation from renewable sources.
- CLO 3.** Differentiate between different types of solar cells, wind turbine designs, and hydropower systems based on their operational principles.
- CLO 4.** Judge the potential environmental impacts and solutions associated with large-scale renewable energy installations.
- CLO 5.** Formulate innovative approaches to optimize the performance and reliability of renewable energy systems.

NOVEL & SMART MATERIALS	
Course Code: 23PHBS011	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge about the Physics of Electronic, Nano and Magnetic Materials
- CLO 2.** Able to understand the physical mechanism in electronic materials
- CLO 3.** Get an understanding of Integrated Circuit (IC) Technology and their Fabrication
- CLO 4.** Able to understand the properties and applications of magnetic materials
- CLO 5.** Get an understanding about magnetic bubbles and transducers and optic sensors.

PLASMA PHYSICS	
Course Code: 23PHBS012	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite: Basic knowledge about classical mechanics and electrodynamics	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Well-versed with basics of plasma and its applications.
- CLO 2.** Equipped with the motion of a charged particle.
- CLO 3.** Able to apply knowledge of waves in cold, warm and hot isotropic plasma.
- CLO 4.** Well-versed with the waves in hot magnetized plasmas, stability and equilibrium.
- CLO 5.** Able to understand the transport processes in plasmas.

NANOPHOTONICS	
Course Code: 23PHBS013	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of the field of nanophotonics.
- CLO 2.** Get an understanding of near field interaction and their application in microscopy.
- CLO 3.** Able to understand the Plasmonics and photonic crystals.
- CLO 4.** Formulate non-linear behaviour of the photonic crystals
- CLO 5.** Well-versed with the application of photonic materials in biotechnology.

NONLINEAR SPECTROSCOPY	
Course Code: 23PHBS014	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would:

- CLO 1.** Describe the differences between linear and nonlinear spectroscopy and their significance.
- CLO 2.** Demonstrate the ability to calculate nonlinear susceptibility and predict signal intensities in various nonlinear spectroscopy processes.
- CLO 3.** Differentiate between different types of nonlinear spectroscopy techniques based on their underlying principles and applications.
- CLO 4.** Critique the potential sources of error in nonlinear spectroscopy measurements and propose strategies for improving data quality.
- CLO 5.** Develop innovative applications of nonlinear spectroscopy in interdisciplinary research fields.

OPTOELECTRONICS	
Course Code: 23PHBS015	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would

- CLO 1.** Describe the characteristics of optoelectronic devices, such as LEDs, lasers, and photovoltaic cells.
- CLO 2.** Demonstrate the ability to design and analyze simple optical waveguides and resonators.
- CLO 3.** Differentiate between various types of lasers and photodetectors based on their operational principles.
- CLO 4.** Judge the challenges and solutions for integrating optoelectronic components into modern technologies.
- CLO 5.** Develop innovative approaches to improve the performance and functionality of optoelectronic devices.

ADVANCED NUCLEAR PHYSICS	
Course Code: 23PHBS016	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite: Basic knowledge about thermodynamics	

COURSE LEARNING OUTCOME (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would

- CLO 1.** List the properties of deuteron in ground state and solve Schrodinger wave equation to explore the properties of deuteron.
- CLO 2.** Interpret the significance of nuclear cross-sections and reaction rates in nuclear processes.
- CLO 3.** Search for different nucleus for production of SHE elements.
- CLO 4.** Analyze the interaction in different region and different scattering process.
- CLO 5.** Design experiments to investigate specific particles with the help of detectors

CHARACTERIZATION OF MATERIALS	
Course Code: 23PHBS017	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be

- CLO 1.** Fluent with good knowledge of the application of small angle X-ray scattering.
- CLO 2.** Get an understanding of working principle and application of electron microscopes.
- CLO 3.** Able to understand the electronic absorption study, acoustic and optical modes in solids.
- CLO 4.** Well-versed with the trace level detection by NMR and ESR.
- CLO 5.** Get familiar with laser as a source of radiation and its characteristics

NANOMAGNETISM AND SPINTRONICS	
Course Code: 23PHBS018	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination:-- Marks
L T P : 3 1 0	Course Category: Minor Stream Course
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Explain the concepts of magnetism and to nano-magnetism.
- CLO 2.** Fluent with good knowledge on the concepts of magnetism in metals
- CLO 3.** Get an understanding of different magnetic interactions.
- CLO 4.** Able to understand the spin dependent transport processes in spintronics devices.
- CLO 5.** Well-versed with the advances in spintronic materials, technology.

QUANTUM FIELD THEORY	
Course Code: 23PHBS019	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Minor Stream Course
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Derive and construct quantum field theories for various physical systems, including scalar, fermionic, and gauge fields.
- CLO 2.** Perform calculations of scattering amplitudes, cross-sections, and decay rates using perturbation theory and Feynman diagrams.
- CLO 3.** Apply symmetry principles to analyze particle interactions, derive conservation laws, and understand the structure of Lagrangians.
- CLO 4.** Apply renormalization techniques to remove divergences and extract finite, meaningful results from quantum field theory calculations.
- CLO 5.** Develop problem-solving skills and enhance critical thinking abilities by tackling complex theoretical and mathematical challenges in the context of quantum field theory.

QUANTUM INFORMATICS AND QUANTUM COMPUTATION I	
Course Code: 23PHBS020	Continuous Evaluation: -- Marks
Credits: 2	End Semester Examination: -- Marks
L T P : 2 0 0	Course Type: Minor Stream Course
Prerequisite: Quantum Mechanics	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Demonstrate a solid understanding of key quantum concepts, including qubits, quantum gates, and superposition, entanglement, and quantum measurement.
- CLO 2.** Create and analyze quantum circuits to perform specific tasks, and understand how to combine quantum gates to construct algorithms.
- CLO 3.** Apply quantum algorithms to solve computational problems more efficiently than classical algorithms, and analyze the advantages and limitations of quantum computation.
- CLO 4.** Formulate the interpretation of Quantum entanglement.
- CLO 5.** Evaluate advantages of quantum algorithm over classical counterparts.

QUANTUM INFORMATICS AND QUANTUM COMPUTATION II	
Course Code: 23PHBS021	Continuous Evaluation: -- Marks
Credits: 2	End Semester Examination: -- Marks
L T P : 2 0 0	Course Type: Minor Stream Course
Prerequisite: Quantum Informatics and Quantum Computation I	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Apply critical thinking and problem-solving skills to analyze and solve quantum computational problems, and present solutions effectively.
2. Stay informed about recent developments and advancements in the field of quantum informatics and quantum computation, and discuss potential future trends.
3. Analyse the quantum computing algorithms.
4. Formulate the quantum computing in the application of cryptography.
5. Evaluate the concepts of lattice based cryptography.

ADVANCED SOLID STATE PHYSICS I	
Course Code: 23PHBS022	Continuous Evaluation: -- Marks
Credits: 2	End Semester Examination: -- Marks
L T P : 2 0 0	Course Type: Minor Stream Course
Prerequisite: Condensed Matter Physics	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge on the glasses and polymers.
CLO 2. Get an understanding of structure of liquid crystals.
CLO 3. Able to understand the phase transitions in solid state materials.
CLO 4. Well-versed with the knowledge of surface physics.
CLO 5. Able to understand the theory of quantum Hall effect

ADVANCED SOLID STATE PHYSICS II	
Course Code: 23PHBS023	Continuous Evaluation: -- Marks
Credits: 2	End Semester Examination: -- Marks
L T P : 2 0 0	Course Type: Minor Stream Course
Prerequisite: Advanced Solid State Physics I	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge on the glasses and polymers.
- CLO 2.** Get an understanding of structure of liquid crystals.
- CLO 3.** Able to understand the phase transitions in solid state materials.
- CLO 4.** Well-versed with the knowledge of surface physics.

CURRICULUM & SYLLABUS



CHOICE-BASED CREDIT SYSTEM (CBCS)

FOR

MASTER OF SCIENCE (M.Sc.)

(2 Year Postgraduate Degree Program)

IN

PHYSICS [w. e. f.

2023-24]

**FACULTY OF SCIENCE AND HUMANITIES
SRM UNIVERSITY DELHI-NCR, SONEPAT**

Plot No.39, Rajiv Gandhi Education City, P.S. Rai, Sonapat Haryana-131029

M. Sc. PHYSICS PROGRAM LEARNING OUTCOMES

- a. Understanding the basic concepts of core courses such as classical mechanics, quantum mechanics, statistical mechanics, and electrodynamics to appreciate the underlying principles governing the natural phenomena through logical and mathematical reasoning.
- b. Understanding the basic concepts of certain advanced fields such as nuclear physics, atomic and molecular physics, solid state physics, plasma physics, and astrophysics, general theory of relativity, nonlinear dynamics, and complex system.
- c. Learning how to carry out experiments in basic as well as advanced areas of physics.
- d. Gaining hands-on experience to work in applied fields.
- e. Developing an attitude and capability for critical thinking and reasoning that can be applied to diverse fields.

MATHEMATICAL PHYSICS	
Course Code: 23PHMS101	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about linear algebra and tensors, differential equation and complex variables	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with various mathematical concepts in linear algebra and tensors.
- CLO 2.** Able to solve second order homogeneous and inhomogeneous differential equations.
- CLO 3.** Well versed with complex variables and evaluate complex integrals using Cauchy Integral theorem in various forms and residue theorem.
- CLO 4.** Familiar with the basics of Group Theory.

CLASSICAL MECHANICS	
Course Code: 23PHMS102	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about Newtonian Mechanics.	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with knowledge of the advanced techniques of classical mechanics and skills to apply those techniques to real world problem.
- CLO 2.** Fluent with the dynamics of rigid bodies and small oscillations.
- CLO 3.** Get a basic understanding of Classical field theory.
- CLO 4.** Get an understanding of special theory of relativity.

QUANTUM MECHANICS I	
Course Code: 23PHMS103	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Pre-requisite: Basic knowledge about Quantum Mechanics.	

COURSE LEARNING OUTCOME

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the understanding of Schrödinger equation and its applications.
- CLO 2.** Fluent with the operator application on wave function and their outcome.
- CLO 3.** Get an understanding of angular momentum algebra.
- CLO 4.** Able to understand the time independent perturbation theory and its applications.

ELECTRODYNAMICS	
Course Code: 23PHMS104	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about Electricity and Magnetism	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge about the fundamental laws of electrodynamics.
- CLO 2.** Get an understanding of EM waves in free space, dielectric and conducting media.
- CLO 3.** Gain understanding of relativistic electrodynamics.
- CLO 4.** Able to understand radiation and related concepts.

SOLID STATE PHYSICS	
Course Code: 23PHMS201	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about crystal physics, band theory of solids	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of crystal structure and various structural parameters
- CLO 2.** Gain understanding of crystal bonding, defects and diffusion in solids.
- CLO 3.** Well versed with concepts of lattice vibrations and phonon modes, and theory of specific heat.
- CLO 4.** Able to understand free electron theory and band theory of solids.

QUANTUM MECHANICS – II	
Course Code: 23PHMS202	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge of quantum well, harmonic oscillator problems.	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the understanding of the time dependent perturbation theory.
- CLO 2.** Fluent with the understanding of the scattering theory and its application.
- CLO 3.** Well versed with the symmetries and identical particles in quantum mechanics.
- CLO 4.** Get an understanding about radiation and relativistic quantum mechanics.

ELECTRONICS	
Course Code: 23PHMS203	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about electronics	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the understanding of the semiconductor devices.
- CLO 2.** Fluent with the understanding of Field effect transistor and its characteristics.
- CLO 3.** Becomes familiar with the working of operation amplifier and its application
- CLO 4.** Able to understand the principles behind oscillators and signal generators.

ATOMIC AND MOLECULAR PHYSICS	
Course Code: 23PHMS301	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about atomic and molecular structure of atom.	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Well versed with the concepts of atomic physics.
- CLO 2.** Able to understand the concepts in Molecular Spectroscopy
- CLO 3.** Fluent with the ideas of electronic band spectra
- CLO 4.** Get an understanding Physics of Laser action and its application in Fluorescence Spectroscopy.

STATISTICAL MECHANICS	
Course Code: 23PHMS302	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about thermodynamics	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Know various statistical terms and their relations with thermodynamic quantities.
- CLO 2.** Understand different ensembles and partition function.
- CLO 3.** Well versed with quantum statistics of ideal gases.
- CLO 4.** Understand phase transition and different models.

NUCLEAR AND PARTICLE PHYSICS	
Course Code: 23PHMS401	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course
Prerequisite: Basic knowledge about thermodynamics	

COURSE LEARNING OUTCOME

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** able to explain the basic properties, structures of nucleus and nuclear models.
- CLO 2.** able to understand deuteron and its properties and explain nuclear forces.
- CLO 3.** Can explain nuclear decay and nuclear reactions.
- CLO 4.** Basic knowledge of elementary particles

PHYSICS LAB – I (General)	
Course Code: 23PHMS151	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course Lab
Prerequisite: Basic knowledge about various parameters involved in experiments.	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Familiar with experimental knowledge of various diodes, transistors and amplifiers.
- CLO 2.** Get an insight into the Physics involved in the experiments.
- CLO 3.** Equipped with knowledge of various components of electronic circuits.
- CLO 4.** Well versed with the theoretical knowledge behind every experiments

PHYSICS LAB – II (General)	
Course Code: 23PHMS251	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Core Course Lab
Prerequisite: Basic knowledge about various parameters involved in experiments.	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Become familiar with experimental knowledge of various diodes, transistors and amplifiers.

- CLO 2.** To get an insight into the Physics involved in the experiments.
- CLO 3.** Equipped with knowledge of various components of electronic circuits.
- CLO 4.** Well versed with the theoretical knowledge behind every experiments

COMPUTATIONAL PHYSICS LAB I	
Course Code: 23PHMS252	Continuous Evaluation: -- Marks
Credits: 2	End Semester Practical Examination:-- Marks
L T P : 0 0 4	Course Type: CORE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of the course, students would be

- CLO 1.** Able to draw the 2D plotting using Gnuplot
- CLO 2.** Equipped with the knowledge of linear and nonlinear fitting using Gnuplot
- CLO 3.** Fluent in data types, arrays and loops concepts required for programming.
- CLO 4.** Well-versed with basic programming.

COMPUTATIONAL PHYSICS LAB II	
Course Code: 23PHBS351	Continuous Evaluation: -- Marks
Credits: 2	End Semester Practical Examination:-- Marks
L T P : 0 0 4	Course Type: CORE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Able to extrapolation, intrapolation and curve fitting
- CLO 2.** Equipped with the knowledge of numerical technique to solve differential and integration problems
- CLO 3.** Fluent in numerical solution of ordinary differential equation.
- CLO 4.** Well versed with basic programming

ADVANCED SOLID STATE PHYSICS I	
Course Code: 23PHMS303	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of transport properties of solids.
- CLO 2.** Get an understanding of optical properties of materials.
- CLO 3.** Well-versed with the magnetic properties of solids and can explain superconductivity.
- CLO 4.** Able to understand the dielectric and ferroelectric properties of solids.

NANO MATERIALS	
Course Code: 23PHMS304	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge on the properties of material at nanoscale.
- CLO 2.** Get an understanding of characterization of nanomaterials
- CLO 3.** Able to understand the growth of thin film and vacuum systems.
- CLO 4.** Well-versed with the techniques of thin film deposition and its characterization.

SOFT MATTER PHYSICS	
Course Code: 23PHMS305	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge about materials viz. liquid crystals, colloids, polymers etc.
- CLO 2.** Able to understand the different statics involved in polymer materials
- CLO 3.** Get an understanding of the elastic properties of soft materials and fluid dynamics.
- CLO 4.** Well-versed with the various interactions involved in soft matter physics

LASER PHYSICS & APPLICATIONS	
Course Code: 23PHMS306	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge Principles of Laser operation
- CLO 2.** Get an understanding of the working of different types of laser
- CLO 3.** Get an understanding of Nonlinear processes
- CLO 4.** Well-versed with the Novel applications of Laser

NANOPHOTONICS	
Course Code: 23PHMS307	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of the field of nanophotonics.
- CLO 2.** Get an understanding of near field interaction and their application in microscopy.
- CLO 3.** Able to understand the Plasmonics and photonic crystals.
- CLO 4.** Well-versed with the application of photonic materials in biotechnology.

NONLINEAR SPECTROSCOPY	
Course Code: 23PHMS308	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of different physical principles underlying in various spectroscopic techniques.
- CLO 2.** Get an understanding of broadening mechanism in saturation spectroscopy.
- CLO 3.** Well-versed with the concept of Coherent Raman spectroscopy and Coherent Anti Raman scattering (CARS) spectroscopy.
- CLO 4.** Able to understand the basic ideas of non-linear spectroscopes.

ANALOGUE ELECTRONICS	
Course Code: 23PHMS309	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOME

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Understanding of the Microwave characteristics and its detection techniques.
- CLO 2.** Understands the basic Radar communication and its performances.
- CLO 3.** The ability to understand the signal transmission by Amplitude and phase modulations.
- CLO 4.** Becomes familiar with the satellite communication techniques.

DIGITAL ELECTRONICS	
Course Code: 23PHMS310	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P: 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge communication system and kinds of noises involves.
- CLO 2.** Get an understanding of working principle behind LAN, WAN, MAN and topology.
- CLO 3.** Able to understand the signal transmission in optical fibres.
- CLO 4.** Well-versed with the working and application of LED and diode LASERS.
- CLO 5.** Able to understand the concept of Optical Joints and Couplers

OPTOELECTRONICS	
Course Code: 23PHMS311	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of the wave guide characteristics and basic structures
- CLO 2.** Get an understanding of the optical field confinement in the optical fibers
- CLO 3.** Able to understand the principles behind various optoelectronic devices
- CLO 4.** Well-versed with the working of semiconductor lasers
- CLO 5.** Able to understand the concept of quantum well devices

NUCLEAR PHYSICS I	
Course Code: 23PHMS312	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Can differentiate different nuclear reactions and calculate cross section.
- CLO 2.** Can explain nuclear fission and fusion.
- CLO 3.** Well aware of different reactors available and their use.
- CLO 4.** Can explain different accelerators.

ASTROPHYSICS - I	
Course Code: 23PHMS313	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite: Knowledge of astrophysics	

COURSE LEARNING OUTCOMES

- CLO 1.** Able to understand the stability and equilibrium of stars.
- CLO 2.** Get an understanding of the various properties of stars.
- CLO 3.** Fluent with up-to date knowledge of the Sun, its various activity features and space weather.
- CLO 4.** Basic knowledge about the composition, structure and evolution of galaxies and related objects.

QUANTUM FIELD THEORY	
Course Code: 23PHMS314	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: MAJOR
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Derive and construct quantum field theories for various physical systems, including scalar, fermionic, and gauge fields.
- CLO 2.** Perform calculations of scattering amplitudes, cross-sections, and decay rates using perturbation theory and Feynman diagrams.
- CLO 3.** Apply symmetry principles to analyze particle interactions, derive conservation laws, and understand the structure of Lagrangians.
- CLO 4.** Apply renormalization techniques to remove divergences and extract finite, meaningful results from quantum field theory calculations.
- CLO 5.** Develop problem-solving skills and enhance critical thinking abilities by tackling complex theoretical and mathematical challenges in the context of quantum field theory.

ADVANCED SOLID STATE PHYSICS II	
Course Code: 23PHMS402	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge on the glasses and polymers.
- CLO 2.** Get an understanding of structure of liquid crystals.
- CLO 3.** Able to understand the phase transitions in solid state materials.
- CLO 4.** Well-versed with the knowledge of surface physics.
- CLO 5.** Able to understand the theory of quantum Hall effect

CHARACTERIZATION OF MATERIALS	
Course Code: 23PHMS403	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge on the structural analysis of materials
- CLO 2.** Get an understanding of working principle and application of electron microscopes.
- CLO 3.** Able to understand the working and different imaging modes of optical microscopes.
- CLO 4.** Well-versed with the trace level detection techniques of NMR and ESR.
- CLO 5.** Get familiar with laser as a source of radiation and its characteristics

NANOMAGNETISM AND SPINTRONICS	
Course Code: 23PHMS404	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge on the concepts of magnetism and nanomagnetism.
- CLO 2.** Get an understanding of domain wall dynamics in nanomagnetic systems.
- CLO 3.** Able to understand the spin dependent transport processes in spintronics devices.
- CLO 4.** Well-versed with the advances in spintronic materials, technology.

FIBER OPTICS SENSORS	
Course Code: 23PHMS405	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Able to understand the wave guide characteristics and basic structures of optical fibres.
- CLO 2.** Able to understand the principle behind the signal dispersion of the guided mode of optical fiber
- CLO 3.** Well-versed with the principles behind spectroscopic application of optical fibers.
- CLO 4.** Fluent with good knowledge of the optical fiber application
- CLO 5.** Well versed with health-based applications of fiber sensors

APPLIED OPTICS	
Course Code: 23PHMS406	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of photonic materials
- CLO 2.** Get an understanding of the basic concepts of Physical optics
- CLO 3.** Able to understand the light behavior in Photonic crystals and Meta materials
- CLO 4.** Well-versed with the optical and imaging techniques
- CLO 5.** Familiar with the concept of nonlinear optical microscopy

ROTATIONAL & VIBRATIONAL SPECTROSCOPY	
Course Code: 23PHMS407	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of Molecular Symmetry and Group Theory
- CLO 2.** Get an understanding of. the Rotational and Vibrational Spectroscopy of diatomic/polyatomic molecules
- CLO 3.** Able to understand the vibrational spectroscopy of diatomic and polyatomic molecules
- CLO 4.** Well-versed with the Various Selection Rules in Raman and Infrared Spectroscopy
- CLO 5.** Able to understand Vibration-rotation spectroscopy

NOVEL AND SMART MATERIALS	
Course Code: 23PHMS408	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge about the Physics of Electronic, Nano and Magnetic Materials
- CLO 2.** Able to understand the physical mechanism in electronic materials
- CLO 3.** Get an understanding of Integrated Circuit (IC) Technology and their Fabrication
- CLO 4.** Able to understand the properties and applications of magnetic materials
- CLO 5.** Get an understanding about magnetic bubbles

MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

, Carrier Trapping and recombination/generation in semiconductors,

MICROPROCESSOR AND INTERFACING	
Course Code: 23PHMS409	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of programming in microprocessor 8085.
- CLO 2.** Get an understanding of programming in microprocessor 8086.
- CLO 3.** Able to understand the working with ICs 8051, 8253, 8259 and 8279.
- CLO 4.** Well-versed with the use microprocessor in the application of temperature, water level, traffic light control etc.
- CLO 5.** Able to receive more information on waveform generation and frequency measurement

SEMICONDUCTOR PHYSICS	
Course Code: 23PHMS410	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge the conductivity in intrinsic and extrinsic semiconductors
- CLO 2.** Get an understanding of the concept of direct and indirect band gap semiconductors
- CLO 3.** Able to understand the with the conductivity at the metal semiconductor interface
- CLO 4.** Well-versed with the principles behind FET, MOSFET, JFET, CMOS, RAM.
- CLO 5.** Able to get knowledge on Lithography.

NUCLEAR PHYSICS II	
Course Code: 23PHMS411	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Can explain interaction of charged particles.
- CLO 2.** Well versed with the knowledge of gas detectors.
- CLO 3.** Good knowledge of semiconductor detectors
- CLO 4.** Can explain light sensing detectors

ASTROPHYSICS - II	
Course Code: 23PHMS412	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

- CLO 1.** Able to understand the basics concepts of observation of the universe.
- CLO 2.** Get an understanding of the basic measurement of stars.
- CLO 3.** Fluent with up-to date knowledge of the star cluster.
- CLO 4.** Detail knowledge about the evolution of the star.

QUANTUM INFORMATICS AND QUANTUM COMPUTATION	
Course Code: 23PHMS413	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: MAJOR
Prerequisite: Advanced Quantum Mechanics	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- CLO 1.** Demonstrate a solid understanding of key quantum concepts, including qubits, quantum gates, and superposition, entanglement, and quantum measurement.
- CLO 2.** Create and analyze quantum circuits to perform specific tasks, and understand how to combine quantum gates to construct algorithms.
- CLO 3.** Apply quantum algorithms to solve computational problems more efficiently than classical algorithms, and analyze the advantages and limitations of quantum computation.
- CLO 4.** Apply critical thinking and problem-solving skills to analyze and solve quantum computational problems, and present solutions effectively.
- CLO 5.** Stay informed about recent developments and advancements in the field of quantum informatics and quantum computation, and discuss potential future trends.

ADVANCED SOLID STATE PHYSICS LAB I	
Course Code: 23PHMS352	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge structural detection of solid state materials.
- CLO 2.** Get an understanding of experimental techniques for finding the optical and electrical properties of materials.
- CLO 3.** Able to understand the thermo-gravimetric analysis of materials.
- CLO 4.** Well-versed with the extent of error involved in the experimental techniques.

LASER & SPECTROSCOPY LAB I	
Course Code: 23PHMS353	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of experiments related to the optical properties of alkali materials
- CLO 2.** Get an understanding of experimental techniques to determine the optical properties of materials
- CLO 3.** Able to understand the band structure of few solids.
- CLO 4.** Well-versed with the extent of error involved in the experimental techniques.

ELECTRONICS LAB I	
Course Code: 23PHMS354	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with good knowledge of general experimental techniques related to optical fibers
- CLO 2.** Get an understanding of experiments related to filter applications and modulation techniques
- CLO 3.** Able to understand the effect of noise in the signal processing.
- CLO 4.** Well-versed with the extent of error involved in the experimental techniques.

CONDENSED MATTER PHYSICS LAB II	
Course Code: 23PHMS451	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with knowledge of measurement instruments and experimental apparatus used in nano physics lab
- CLO 2.** Get an understanding of precaution.
- CLO 3.** Able to analyze the data.
- CLO 4.** Able to estimate the error in measurements.

LASERS AND SPECTROSCOPY LAB II	
Course Code: 23PHMS452	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of experiments for finding optical properties of thin films.
- CLO 2.** Get an understanding of vibrational and defect modes study by Raman spectroscopy.
- CLO 3.** Able estimate the physical parameters from the experimental data.
- CLO 4.** Fluent with different error estimation.

ELECTRONICS LAB II	
Course Code: 23PHMS453	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of transistor application as an amplifier.
- CLO 2.** Get an understanding of different electronic devices.
- CLO 3.** Able to design of oscillators.
- CLO 4.** Fluent with different applications of Op-amp and microprocessor.

CLEAN AND RENEWABLE ENERGY PHYSICS	
Course Code: 23OEPH101	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Discipline Specific Elective
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Fluent with the fundamentals of renewable energy systems.
- CLO 2.** Get an understanding of solar and biomass energy.
- CLO 3.** Able to understand the hydrogen energy and different energy storage systems.
- CLO 4.** Well-versed with the wind, thermoelectric, hydropower and ocean energy.
- CLO 5.** Able to understand the current energy scenario and the significance of renewable energy technology

BIOPHYSICS	
Course Code:21OEPH102	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Generic Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of Length and time scales in biology.
- CLO 2.** Get an understanding of Cellular dynamics
- CLO 3.** Get an understanding of the brain & Information in living systems
- CLO 4.** Able to design of oscillators.
- CLO 5.** Fluent with knowledge on Ecosystems.

MATLAB	
Course Code:21OEPH201	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Generic Elective
Prerequisite:	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of basic tools in MATLAB.
- CLO 2.** Get an understanding of MATLAB programming.
- CLO 3.** Fluent with different MATLAB scripts.

PROGRAMMING IN C	
Course Code: 21OEPH202	Continuous Evaluation: -- Marks
Credits: 4	End Semester Examination: -- Marks
L T P : 3 1 0	Course Type: Generic Elective
Prerequisite	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

- CLO 1.** Equipped with the knowledge of basic tools in C.
- CLO 2.** Get an understanding of C programming.
- CLO 3.** Fluent with different C scripts.