As per the NEP 2020

Bachelor of Science

(Effective from Academic Year 2024-2025 onwards)

Faculty of Science

Pandit Deendayal Upadhyaya Shekhawati University
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As per the NEP 2020

Physics

(Effective from Academic Year 2024-2025 onwards)

Faculty of Science

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Bachelor of Physical Science
(CBCS) As per the NEP 2020 (Semester I to IV)
w.e.f. the Academic Session 2024-25
Discipline: Physics
Faculty: Science

Semester-I To IV

Semester	Course title	Credits	Course Code	Credit distribution of the course			Eligibility criteria
				Lecture	Tutorial	Practical/ Practice	
I	Title of the paper: Mechanics & Oscillations	DSC (3)	24BPH5101T	3	0	0	10+2 from any recognized Board
I	Physics Lab	DSC (1)	24BPH5101P	2	0	0	
II	Electromagnetism	DSC (3)	24BPH5201T	3	0	0	
II	Physics Lab	DSC(1)	24BPH5201P	2	0	0	
III	Optics	DSC(3)	24BPH6301T	3	0	0	
III	Physics Lab	DSC(1)	24BPH6301P	2	0	0	
IV	Thermodynamics and statistical Physics	DSC (3)	24BPH6401T	3	0	0	
IV	Physics Lab	DSC8 (1)	24BPH5101T	2	0	0	

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Mechanics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.

Learning outcomes:

By studying this course students will gain basic knowledge of Inertial and non-inertial frames of reference and their applications in rotational frames. They also learn about centre of mass, rigid body dynamics, Motion under central forces. They will understand the effect of damping on oscillatory motion as well as on forced vibration and coupled oscillation

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Semester-I
Mechanics & Oscillations

Course Title:	Title of the paper: Mechanics & Oscillations	Course Code: 24BPH5101T
Total Lecture hour 40		
Unit I	**Physical Law and frame of Reference:** (a) Inertial and non-inertial frames, Transformation of displacement, velocity, acceleration between different frames of reference involving translation. Galilean transformation and invariance of Newton's laws. (b) Coriolis Force: Transformation of displacement, velocity and acceleration between rotating frame, Pseudo forces, Coriolis force, Motion relative to earth, Focult's pendulum. (c) Conservative Forces: Introduction about conservative and non-conservative forces, Rectilinear motion under conservative forces, Discussion of potential energy curve and motion of a particle.	**Hours** **10**
Unit II	**Centre of Mass:** Introduction about Centre of Mass. Centre of Mass Frame: Collision of two particles in one and two dimensions (elastic and inelastic), Slowing down of neutrons in a moderator, Motion of a system with varying mass, Angular momentum concept, conservation and charge particle scattering by a nucleus. **Rigid body:** Equation of a motion of a rotating body. Inertial coefficient. Case of J not parallel to w. The kinetic energy of rotation and the idea of principal axes. The processional motion of the spinning Top.	**10**
Unit III	**Motion under Central Forces:** Introduction about Central Forces, Motion under central forces, gravitational interaction. Inertia und gravitational mass, General solution under gravitational interaction. Keplers laws, Discussion of trajectories, Cases of elliptical and circular orbits, Rutherford scattering. **Damped Harmonic Oscillations:** Introduction about oscillations in a potential well, Damped force and motion under damping. Damped Simple Harmonic Oscillator, Power dissipation, Anharmonic oscillator and simple pendulum as an example.	**10**
Unit IV	**Driven Harmonic Oscillations:** Driven harmonic oscillator with damping, Frequency response. Phase factor, Resource, Series and parallel of LCR circuit, Electromechanical Galvanometer. **Coupled Oscillations:** Equation of motion of two coupled Simple Harmonic Oscillators, Normal modest motion in mixed modes. Trust behavior, Dynamics of a number of oscillators with neighbor interactions.	**10**

Reference Books:

1. Mechanics, Berkeley Physics, Vol-I, Knight,et. Al. 2007, Tata McGraw-Hill
2. An Introduction to Mechanics, D.Kleppner, R.J.Kolenkow,1973, McGraw-Hill.
3. Feynman Lectures, Vol-I Mechanics, L.D.Landau, E.M.Lifshitz, Butterworth-Heinemann.
4. Mechanics, D.S.Mathur, S.Chand and company Limited.
5. Theoretical Mechanics, M.R. Spiegel,2006, Tata Mcgraw-Hill.
6. Mechanics: Keith R.Taylor

Course Title:	Physics Lab	Course Code: 24BPH5101P
Total Lecture hour 26		
1	Study the variation of the time period with amplitude in large angle	

	oscillations using a compound pendulum	
2	To study the damping using a compound pendulum	
3	To study the excitation of normal modes and measure frequency splitting into two coupled oscillators	
4	To study the frequency of energy transfer as a function of coupling strength using coupled oscillators.	
5	To determine Young's modulus by bending of beam.	
6	To determine Y, η,σ by searle's method.	
7	To determine modulus of rigidity of a wire using Maxwell's needle.	
8	To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficients with the assistance of a conducting lamina	
9	Study of Normal mode of a compound pendulum.	
10	Study of oscillations in mixed modes.	
Reference Books:		
1		
2		

Semester-II

Electromagnetism

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of the fundamental concepts of electromagnetism. The course aims to develop their knowledge and skills in analyzing and solving problems related to Electromagnetism, using appropriate mathematical formalism and physical concepts.

Learning outcomes

Upon completion of the course, students should be able to understand the concepts of scalar and vector fields with different theorems. They can understand the Concept of electric field, electric field in matter, magnetostatics and magnetic field in matter and also about the electromagnetic wave spectrum with the propogation of electromagnetic waves in different mediums.

Course Title:	**Title of the Paper: Electromagnetism**	**Course Code: 24BPH5301T**
Total Lecture hour 40		
Unit I	**Scalar and Vector Fields:** Concept of Field, Scalar and Vector Fields, Gradient of scalar field, Physical significance and formalism of Gradient, Divergence and Curl of a vector field Cartesian co-ordinates system, Problems based on Gradient, Divergence and curl operators. Concept of Solid angle, Gauss divergence and Stoke's theorem. Gauss law from inverse square law. Differential form of Gauss law. Electric Field and Potential Energy: Invariance of Charge, Potential energy of	**Hours** **10**

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	system of (i) Discrete N-charges (ii) Continuous charge distribution Energy required to built a uniformly charged sphere, classical radius of electron, Electric field due to a short electric dipole, Interaction of electric dipole with external uniform and non uniform electric field, potential due to a uniformly charged spherical shell. Poisson's and Laplace equations in Cartesian co-ordinates and their applications to solve the problems of electrostatics.	
Unit II	**Electric field in matter:** Multipole expansion, definition of moments of charge distribution, Dielectrics, Induced dipole moments, polar non polar molecules, Free and bound charges, Polarization, Atomic polarizabilty, electric displacement vector, electric susceptibility, dielectric constant, relation between them. Electric potential and electric field due to a uniformly polarized sphere (1) outside the sphere (8) at the surface of the sphere (m) inside the sphere, Electric field due to a dielectric sphere placed in a uniform electric field (a) outside the sphere (b) inside the sphere, Electric field due to a charge placed in dielectric medium and Gauss law, Clausius-Mossotti relation in dielectrics	**10**
Unit III	**Magnetostatics and Magnetic field in matter:** Lorentz force, properties of magnetic field, Ampere's law, field due to a current carrying Solid conducting cylinder (a) outside (b) at the surface and (i) inside the cylinder. Ampere's law in differential form, Introduction of Magnetic Vector potential, Poisson's equation for vector potential, Deduction of Bio-Savart law using Magnetic Vector potentials, Differential form of Ampere's law. Atomic magnet, Gyromagnetic ratio, Bohr-mgneton Larmor frequency, induced magnetic moment and dia- magnetism, spin magnetic moment, para and ferro magnetism, Intensity of magnetization, Magnetic permeability and Susceptibility, free and bound current densities, Magnetic field due to a uniformly magnetized material and Non- uniformly magnetized material.	**10**
Unit IV	Maxwell's Equations and Electromagnetic Waves Displacement current, Maxwell's Equations, Electromagnetic waves, Electromagnetic waves in an Isotropic and Dispersive medium, Properties of electromagnetic waves, Energy density of Electromagnetic waves, Pointing vector, Radiation pressure of free space, Electromagnetic waves in Dispersive medium, Spectrum of Electromagnetic waves.	**10**

Reference Books:

1	Electricity & Magnetism: A.S. Mahajan & Abbas A. Rangwala, Tata McGraw-Hill
2	Introduction to electrodynamics- David J. Griffith, Prentice Hall
3	Berkley Physics Course, Vol-II, Edward M. Purcell
4	Fundamental University Physics Vol II: Fields and waves, M.alonso and E.J. Finn, Addison-Wesley Publishing Company

Practical Paper

Course Title:	**Title of the Paper: Physics Lab**	**Course Code: 24BPH5301P**
Total Lecture hour 26		
1. To study the Faraday's law of electromagnetic induction		
2. To Study the variation of power transfer by two different loads by a D.C. source and to verify the maximum power transfer theorem.		
3. To study the variation of charge and current in an RC circuit with a different time constant (Using a		

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DC source)
4. To study the behavior of an RC circuit with varying resistance and capacitance AC mains as a power source and also to determine the impendence and phase relations
5. To study the rise and decay of current in an LR circuit with a source of constant emf
6. To study the voltage and current behavior of an LR circuit with an AC power source. Also determine power factor, impedance and phase relations.
7. To study the magnetic field along the axis of a current-carrying circular coil. Plot the necessary graph and hence find the radius of circular coil.
8. To study the frequency response of a series LCR series circuit and to estimate the resonant frequency and to find the radius of the circular coil.
9. To study the frequency response and to find resonant frequencies of LCR parallel circuits. Also to find the quality factor and band width.
10. To determine the specific resistance of a material and determine the difference between two small resistance using carey foster bridge
11. To convert a galvanometer in to an ammeter of a given range.
12. To convert a galvanometer in to voltmeter of a given range

Semester III

Optics

Learning Objectives

The objective of the course is to provide students with a comprehensive understanding of Optics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these to Optics, using appropriate mathematical formalism and physical concepts.

Learning outcomes

Upon completion of the course, students should be able to understand the concepts of Interference and diffraction with their classification and applications. They also learn about the basic concepts of polarization, Laser and Holography.

Paper – V

Course Title:	**Optics**	**Course Code: 24BPH6301T**
Total Lecture hour 40		**Hours**
Unit I	Concept of spatial and Temporal Coherence, Young's double slit experiment Types of interference. **Interference by division of wave fronts**: Fresnel's Biprism, Measurement of wavelength and thickness of a thin transparent sheet. **Interference by division of amplitude**: Interference in thin films of constant thickness in transmitted and reflected waves. Interference produced by a wedge shaped film. Newton rings. Determination of wavelength and refractive index by Newton's Rings. Fringes of equal inclination (Haidinger Fringes) and equal thickness (Fizzau Friges), Michelson's Interferometer, shape of Fringes. Measurement of	**10**

	wavelength, difference between two spectral lines and thickness of a thin transparent sheet.	
Unit II	**Fresnel's diffraction**, Half period zones. Fresnel's diffraction at a circular aperture, straight edge and rectangular slit. Zone plate, Multiple foci of a Zone plate. Comparison between zone plate and convex lens. **Fraunhofer diffraction** by single slit and a circular aperture. Fraunhofer diffraction by N parallel slits with two slits as a special case. Missing orders. Plane diffraction Grating and its use in determining wavelength. Dispersion by Grating. Rayleigh's criterion of resolution. Resolving power of a Telescope and Grating.	**10**
Unit III	**Polarization**: Plane Circular and Elliptically Polarized light. Polarization by reflection. Double refraction and Huygens's explanation of Double refraction. Production and detection of plane, circular and Elliptically polarized light. Quarter wave and Half wave plate. Optical activity. Specific rotation. Bi-quartz and half shade Polarimeters and their comparison.	**10**
Unit IV	**LASER:** Spontaneous and Stimulated emission. Einstein's coefficients. Energy density of radiation as a result of stimulated emission and absorption, population inversion. Method of optical pumping. Energy level schemes. He-Ne, Ruby, CO2 laser **Holography:** Basic concept of Holography, Principle. Theory Construction and reconstruction of image. Application of holography.	**10**

Reference Books:

1	Optics by Brijlal and Subramanium, S. Chand Publishing
2	Principles of Optics by B.K.Mathur, Gopalal Printing
3	Optics by D.P. Khandelwal, Himalaya Publishing House.
4	Introduction to modern Optics by A.K. Ghatak, Mcgraw Hill.
5	An introduction to modern optics by G.R. Fowels, Dover Publications
6	Fundamentals of Optics by Ashok Kumar, D.R. Gulati & H.R. Gulati, R. Chand & Co.

Practical Paper

Course Title:	**Title of the Paper: Practical**	**Course Code: 24BPH6301P**

Total Lecture hour 26

1. Using platinum resistance thermometer find the melting point of a given substance
2. Using Newton's ring method find out the wavelength of a monochromatic source
3. To determine dispersive power of a Prism
4. To determine wavelength by Grating.
5. To determine wavelength by Biprism
6. Plot thermos emf versus temperature and find the neutral temperature
7. Determination of Band gap using a Junction Diode
8. To study characteristics of a given transistor PNP/NPN.(Common Base, Common Emitter, Common collector configuration)
9. Measurement of inductance of coil by Anderson's bridge
10. Measurement of capacitance and dielectric constant of a liquid by de- Sauty Bridge.

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Semester-IV
Thermodynamics and statistical Physics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Thermodynamics and Statistical Physics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these to Thermodynamics and Statistical Physics , using appropriate mathematical formalism and physical concepts.

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Learning outcomes

Upon completion of the course, students should be able to understand the concepts of Thermal and adiabatic interactions, Cryogenics and about different velocities followed by gaseous particles. They also able to understand the transport phenomena, Statistics with their classifications.

Course Title:	**Title of the Paper: Thermodynamics and statistical Physics**	**Course Code: 24BPH6401T**
Total Lecture hour 40		
Unit I	**Thermal and adiabatic interactions:** Thermal interactions: Zeroth law of thermodynamics. System in thermal contact with a heat reservoir (canonical distribution): Energy fluctuations, Entropy of a system in a heat bath: Helmholtz free energy: Adiabatic interaction and Enthalpy. General interaction and first law of thermodynamics. Infinitesimal general interaction. Gibb's free energy. Phase transitions. Clausius Clapeyron equation. Vapor pressure curve. Maxwell relations and their applications. Heat engine and efficiency of engine. Carnot's Cycle. Thermodynamic scale as an absolute scale.	**Hours** **10**
Unit II	**Production of low temperature and applications**: Joule Thomson expansion and Joule Thomson expansion coefficient for Ideal as well as Vander Wall's gas, porous plug experiment, temperature inversion. Regenerative cooling. Cooling by adiabatic expansion and demagnetization. Liquid Helium, He I and He II, super fluidity. Quest for absolute zero. Nernst heat theorem. **The distribution of molecular velocities**: Distribution law of molecular velocities most probable, average and rms velocities. Energy distribution function, effusion and molecular beam. Experimental verification of the Maxwell velocity distribution. The principle of equipartition of energy.	**10**
Unit III	**Transport phenomena**: Mean free path, distribution of free paths: coefficients of viscosity thermal conductivity, diffusion and their inter-relation. **Classical Statistics:** Validity of classical approximation: Phase space, micro and macro states. Thermodynamical probability; relation between entropy and thermodynamical probability: Monatomic ideal gas Barometric equation. Specific heat capacity of diatomic gas. Heat capacity of solids.	**10**
Unit IV	**Quantum Statistics**: Black body radiation and failure of classical statistics. Postulates of quantum statistics. Indistinguishability, wave function exchange degeneracy, a priori-probability, Bose-Einstein statistics and its distribution function; Planck distribution function and radiation formula. Fermi-Dirac	**10**

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	statistics and its distribution function, contact potential. Thermionic emission, Specific heat anomaly of metals: Nuclear spin statistics (para and ortho hydrogen).	

Reference Books:

1	Thermal Physics by Kittel, San Francisco, W.H. Freeman Publisher.
2	An Introduction to thermodynamics by Y.V.C.Rao, Universities Press.
3	Thermodynamics: A Completer Undergraduate course by Andrew M.Steane, OUP Oxford.
4	Statistical and Thermal Physics by S.Loknathan, R.S.Gambhir, PHI learning Publisher.
5	Statistical Physics by Berkeley Series Vol.V, McGraw Hill India.

Practical Paper

Course Title:	Title of the Paper: Practical	Course Code: 24BPH6401P

Total Lecture hour 26

1. To determine thermal conductivity of a bad conductor by Lee's method.
2. Determine the thermodynamical constant using Clement and Dsorme's method)
3. Determination of ballistic constant of a Ballistic Galvanometer.
4. Study of high resistance by leakage method.
5. Study of variance of total thermal radiation with temperature.
6. To determine e/m by Thomson's method
7. Study of Half wave rectification using single Diode and application of L and pi section filters
8. Study of Full wave rectification using single Diode and application of L and pi section filters
9. Determination of power factor of a given coil using CRO
10. Study of single stage transistor audio amplifier.

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