As per the NEP 2020

Bachelor of Science

Physics

(Effective from Academic Year 2024-2025 onwards)

Pandit Deendayal Upadhyaya Shekhawati University

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Semester – I

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 u89nderstand the effect of damping on oscillatory motion as well as on forced vibration and coupled oscillation

Course Title:	Mechanics & Oscillations	Course Code: 24BPH5101T
Total Lecture hour 45		**Hours**
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.	12
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.	13
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

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Course Title:	**Physics Lab**	**Course Code: 24BPH5101P**
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.	

Semester – II

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:	**Electromagnetism**	**Course Code: 24BPH5301T**
Total Lecture hour 45		**Hours**
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 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.	13
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	12

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	charge placed in dielectric medium and Gauss law, Clausius-Mossotti relation in dielectrics	
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

Course Title:	**Physics Lab**	**Course Code: 24BPH5301P**

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 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

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Semester – III

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.

Course Title:	**Optics**	**Course Code: 24BPH6301T**
Total Lecture hour 45		**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 wavelength, difference between two spectral lines and thickness of a thin transparent sheet.	13
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.	**12**
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, CO_2 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.

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Course Title:	Physics Lab	Course Code: 24BPH6301P

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.

Semester – IV

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.

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 will also able to understand the transport phenomena, Statistics with their classifications.

Course Title:	Thermodynamics and statistical Physics	Course Code: 24BPH6401T
Total Lecture hour 40		**Hours**
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.	12
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.	13
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	10

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	of solids.	
Unit IV	**Quantum Statistics**: Black body radiation and failure of classical statistics. Postulates of quantum statistics. Indistinguishability, wave function exchange degeneracy, apriori-probability, Bose-Einstein statistics and its distribution function; Planck distribution function and radiation formula. Fermi-Dirac statistics and its distribution function, contact potential. Thermionic emission, Specific heat anomaly of metals: Nuclear spin statistics (para and ortho hydrogen).	**10**

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.

Course Title:	**Physics Lab**	**Course Code: 24BPH6401P**

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 oftotal 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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Semester V

Course Objectives

The objective of the course Electronics and solid state physics is to provide knowledge of basic networks and network theorems, semiconductors, rectifiers, transistors and their types and amplifiers. This course also provides a good knowledge of various types of bindings, experimental features of superconductivity, lattice specific heat, formation of bands and Hall Effect.

Course outcomes:

On completion of this course students will be able to understand about basics of network and network theorems, semiconductors, rectifiers, transistors and their types and amplifiers with feedback. Student will also be able to know about various types of bindings, super conductivity, lattice specific heat, formation of bands and Hall Effect.

Course Title:	**Electronics and Solid State Physics**	**Corse Code: 24BPH7501T**
Total Lecture hours 45		
Unit I	**Four Terminal Network**: Impedance (Z), Admittance (Y) and Hybrid (h) parameters of any Four terminal network. Input, output and mutual impedence for an active four terminal network. Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem. **P-N Junction:** Charge densities in N and P semiconductors; conduction by drift and diffusion of charge carriers; P-N diode equation; capacitance effects. **Rectifiers:** Half wave, full wave and bridge rectifier, calculation of ripple factor, efficiency and regulation, Voltage stabilization by Zener diode.	**11**
Unit II	**Transistor:** Notations and V-I characteristics for bipolar junction transistor, concept of load line and operating point, hybrid parameters. Transistor as Amplifiers: CB, CE, CC configurations, its characteristic curves and their equivalent circuits. Analysis of transistor amplifiers using hybrid parameters and its frequency response. Fixed and emitter biasing, bias stability in transistor circuits. **Amplifiers with Feedback**: Concept of feedback, positive and negative feedback, voltage and current feedback circuits, Advantages of negative feedback- stabilization of gain by negative feedback, Effect of feedback on output and input resistance. Reduction of nonlinear distortion by negative feedback.	**12**
Unit III	**Crystal Structure:** Space lattice and crystal structure, bravis lattice, Miller indices and crystal structure, spacing of planes in crystal lattice, determination of different crystal properties for SC, FCC, BCC,HCP and perovaskite structure, X-ray diffraction and Bragg's Law, Laue equations of X-ray diffraction, Debye Scherer formula **Experimental Features of Superconductivity:** Critical temperature, critical magnetic field, Meissner effect, type I and II superconductors, isotope effect, London equation and penetration depth, idea of BCS theory (no derivation), Cooper pairs, coherence length DC and AC Josephson effect(no derivation).	**10**
Unit IV	**Thermal and Electrical properties of solids**: Concepts of thermal Energy and phonons, internal energy and specific heat, Einstein and Debye model of lattice specific heat of solids, electronic Contribution to the specific heat of metals, thermal conductivity of the lattice. Drude-Lorentz theory and Sommerfeld theory of electrical conductivity, Widemann-Franz's Law, Hall Effect in metals. **Band Theory:** Formation of bands, periodic potential of a solid, wave function in a periodic lattice and Bloch theorem, Kronig Penny model, velocity of the Bloch electrons and effective mass, crystal momentum and physical origin of the effective mass, negative effective Mass and concept of holes.	**12**

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Reference and Reading Books:

1. Elements of Electronics, M.K. Bagde, S.P. Singh and Kamal Singh, 2002, S. Chand & Company Ltd.
2. Electronics: Fundamentals and Applications by J.D. Ryder, 2004, Prentice Hall.
3. Electronic Devices by Thomas L. Floyd, 2008, Pearson India
4. Handbook of electronics by Gupta and Kumar
5. Handbook of electronics by G.K. Mithal
6. Perspectives of Modern Physics byA Beiser.
7. Solid state Physics by G.I. Epifanov (Mir r Publisher ,)
8. Introduction to solid state physics by C. Kittel (Weley Eastern Ltd.)
9. Elements of Solid State Physics by J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
10. Solid State Physics by N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
11. Elementary Solid State Physics by M. Ali Omar, 1999, Pearson India
12. Solid State Physics by M.A. Wahab, 2011, Narosa Publication

Course Objectives:
The objective of the course is to develop practical skills in experiments and to enhance problem-solving and analytical skills by analyzing experimental data and interpreting results. To promote scientific inquiry, critical thinking, and the ability to design and execute experiments

Course outcomes:
By the end of the course, students should be able to demonstrate proficiency in using various components and instruments required for conducting experiments. Student will be able to interpret experimental results and draw conclusions based on data analysis. Develop skills in accurately measuring physical quantities and recording experimental observations.

Exam Scheme
Student will have to perform one experiment in end semester examination and duration of exam will be 4 Hours.

Marks distribution

Student type	Experiment	Viva-voice	Record/File	Maximum Marks
Regular	30	10	10	50
Non-Collegiate	32	18	N/A	50

Marking distribution in Experiment

Student type	Theory/ Formula	Figure/ Circuit	Observations	Calculation	Results/ Discussion	Precaution
Regular	4	2	12	8	3	1
Non-Collegiate	4	2	14	8	3	1

Course Title:	**Physics Lab**	**Course Code: 24BPH7501P**
	A total of seven experiments must be performed by the students to complete the laboratory course. Experiments of equal standard can be designed to satisfy the minimum condition. This should be intimated and approved by the Convener, Board of Studies before the start of the academic session.	

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	1. Study of a L-C transmission line- a. At fixed frequency b. At variable frequency 2. To design and study of an RC phase shift oscillator and measure output impedance (frequency response with change of component or R and C). 3. To study a voltage multiplier circuit to generate high voltage DC from AC. 4. Study OR, AND, and NOT logic gates using discrete components and compare them with TTL integrated circuits (ICs). 5. Application of operational amplifier (OP-AMP) as: a. Buffer (for accurate voltage measurement) b. Inverting amplifier c. Non Inverting amplifier 6. Study of RC transmission line at 50 Hz. 7. To obtain resonance frequency and resonance curves for Series and parallel LCR circuit. 8. Study the characteristics of field effect transistor (FET) and design/study amplifier of finite gain. 9. Study the temperature dependence of resistance of a semiconductor (Four probe method). 10. Study I-V characteristics of junction and Zener diode. 11. To find the magnetic susceptibility of paramagnetic solution using Quincke's method 12. To determine the Specific Heat of a Liquid using a Calorimeter. 13. To draw BH curve of Iron (Fe) using Solenoid and determine energy loss from hysteresis loop.

Semester VI

Course Objectives

The objective of the course Quantum mechanics and spectroscopy is to provide basic knowledge of development of quantum mechanics, uncertainty relation, operator, Eigen function and eigenvalues, solution of Schrodinger wave equation to one dimension box, potential well, potential step, potential barrier, and simple harmonic oscillator. This course also provides basic knowledge of atomic and molecular spectroscopy.

Course outcomes:

On completion of this course students will be able to understand about basic knowledge of development of quantum mechanics, uncertainty relation, operator, Eigen function and eigenvalues, solution of Schrodinger wave equation to one dimension box, potential well, potential step, potential barrier, and simple harmonic oscillator. Student will be able to gain knowledge of atomic and molecular spectroscopy.

Course Title:	**Quantum Mechanics and Spectroscopy**	**Corse Code: 24BPH7601T**
Total Lecture hours 45		
Unit I	**Development of Quantum Mechanics**: Only qualitative discussion no derivation in explaining difficulties of classical mechanics to explain the black-body emission spectrum, specific heat of solid, concept of Plank's quanta and radiation law, photo electric effect and Einstein's explanations. Compton Effect, De-Broglie hypothesis, diffraction experiments for wave particles (Davisson-Germer experiment). Uncertainty principle, application of uncertainty principle to explain ground state energy of hydrogen atom, ground state energy of simple harmonic oscillator, natural width of spectral lines, and non-existence of electron in nucleus. **Operators in Quantum Mechanics**: Definition of linear operator and Hermitian operator, product of two operators, commuting and non- commuting operators. State function, expectation value of dynamical variable-position, momentum and energy. Fundamental postulates of quantum mechanics, Eigen function and Eigen values. Orthogonal wave functions, wave packet, group and phase velocities, Gaussian wave packet.	13

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Unit II	**Schrödinger wave equation**: general equation of wave propagation, propagation of matter waves, time dependent and time-independent Schrödinger equation, wave function representation (ψ), physical meaning of ψ. properties and conditions on ψ, postulates of wave mechanics, operators, observable and measurements; probability current density. **Time independent Schrödinger equation**: stationary state solution, one dimensional problem: particle in one dimensional box, Eigen functions and eigenvalues, discrete levels, generalization into three dimension and degeneracy of energy levels.	10
Unit III	**Solution of Schrödinger wave equation**: Potential step and rectangular potential barrier, calculation of reflection and transmission coefficient, Qualitative discussion of the application to alpha decay (tunnel effect), square well potential problem, calculation of transmission coefficient. **Bound state problems**: Particle in one dimensional infinite potential well and finite depth potential well, energy value and Eigen functions. Schrödinger equation for simple harmonic oscillator and its solution, Eigen function, eigenvalues, zero-point energy.	11
Unit IV	**Atomic spectroscopy:** Energy level derivation for H-atom, quantum features of hydrogen spectra and hydrogen like spectra, Stern-Gerlach experiment, electron spin, spin magnetic moment Spin-orbit coupling. Qualitative explanation of fine structure, Franck-Hertz experiment. Zeeman effect, normal Zeeman splitting, **Molecular spectroscopy:** Concept of rigid rotator, rotational energy levels, rotational spectra, selection rules, intensity of spectral lines, isotopic effect; Vibrational energy levels, vibrational spectra, selection rules, isotopic effect	11

Reference and Reading Books:

1. Introduction to Modern Physics by H.S. Mani, G.K. Mehta , East West Press Pvt. Ltd., New Delhi (1988)
2. Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education
3. Quantum Mechanics - Concepts and Applications, N Zettili , 2009, Wiley.
4. Quantum Mechanics Theory and Applications by A Ghatak & S Lokanathan, McGraw Hill Ed.
5. Perspective of modern physics by A. Beiser
6. Fundamental of molecular spectroscopy by banwell
7. Atomic & Molecular Spectra: Laser by Raj kumar
8. Atomic and Molecular Spectroscopy: Basic Concepts and Applications by Rita Kakkar, S.Chand publication.

Course Objectives:
The objective of the course is to develop practical skills in experiments and to enhance problem-solving and analytical skills by analyzing experimental data and interpreting results. To promote scientific inquiry, critical thinking, and the ability to design and execute experiments.

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Non-Collegiate	32	18	N/A	50

Marking distribution in Experiment

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Course Title:	**Physics Lab**	**Course Code: 24BPH7601P**
	A total of seven experiments must be performed by the students to complete the laboratory course. Experiments of equal standard can be designed to satisfy the minimum condition. This should be intimated and approved by the Convener, Board of Studies before the start of the academic session.	
	1. Study of polarization by reflection from a glass plate with the help of Nicol's prism and photocell and verification of Brewster's Law and Malus's Law. 2. Determination of e/m by Helical method. 3. Determination of e/m using magnetron method. 4. Verification of Rutherford and Soddy's law of radioactive disintegration using dices and statistical board. 5. To Verify Gaussian distribution law using dices and statistical board. 6. Determination of Planck's constant by photo cell (retarding potential method using optical filters, preferably five wavelengths). 7. Determination of Planck's constant using Solar cell 8. To study the characteristics of different LED and determine Planck's constant value. 9. Determination of Stefan's constant (Black body method). 10. Study of Iodine spectrum with the help of grating and spectrometer and ordinary bulb light. 11. Study of the characteristics of a GM counter and verification of Inverse Square Law for same strength of a radioactive source. 12. Study of Beta absorption in a foil using GM counter. 13. Measurement of electric charge by Millikan's Oil Drop method.	

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