ST JOSEPH'S UNIVERSITY

BENGALURU-27

School of Physical Sciences

DEPARTMENT OF PHYSICS

Curriculum for B.Sc. 2024-27

as per

SEP- 2024

UNDERGRADUATE PROGRAMME SYLLABUS FOR

I-IV semester

Course Outcomes and Course Content

Semester	I
Paper Code	**PH 124**
Paper Title	**Mechanics and Properties of Matter**
Number of teaching hours per week	03
Total number of teaching hours per semester	45
Number of credits	03

Objective of the Paper:

To make the students understand and learn the basic concepts of Mechanics and Properties of Matter in detail which makes a firm basis for the advanced topics taught in higher semesters. The paper gives a detailed overview of units and measurements, co-ordinate systems, relativity, basic mechanics of system of particles and gravitation which are the basic building blocks for understanding classical mechanics.

Semester- I

PH124: MECHANICS AND PROPERTIES OF MATTER

1. Units and measurements: dimensions of physical quantities, dimensional formulae.
Coordinate system: Cartesian co-ordinate system - Vectors and scalars, addition of vectors, multiplication of vectors - dot product, cross product, Geometrical interpretation of dot and cross product. resolution of vectors, unit vectors in plane polar co-ordinate system $\left(\hat{r},\hat{\theta},d\hat{r}/d\theta,d\hat{\theta}/d\theta\right)$,Velocity($\vec{V}=\vec{V}_r+\vec{V}_\theta$) and acceleration ($\vec{a}=\vec{a}_r+\vec{a}_\theta$) in polar coordinate system. Uniform circular motion-centripetal acceleration. Velocity and acceleration in Cartesian coordinate system.

2. Momentum and Energy:, Centre of mass, velocity and acceleration of centre of mass. Total linear momentum about the centre of mass, system of two particles, equation of motion of centre of mass, and rocket propulsion-single stage. (**8 Hours)**

Self study : System of units (CGS and SI), measurement of length, mass and time, Fictitious forces. Coriolis force. Work-Energy theorem, multistage rocket propulsion. **(2 hours)**

3. Dynamics of Rigid bodies: Rotational motion about an axis, moment of inertia and physical significance, angular momentum, torque on a rigid body, law of conservation of angular momentum, examples of conservation of angular momentum. Rotational energy. Theorems of perpendicular and parallel axes. M I of rectangular Lamina, circular disc, and solid cylinder. Flywheel. Theory of compound pendulum and determination of g. (**10 Hours)**

4. Central force and gravitation: Conservative force – central force, angular momentum in central force field, motion under central force, law of equal areas, nature of motion under central force. Kepler's laws (statements), law of time periods($T^2 \alpha A^3$). Newton's law of Gravitation, Gravitational potential energy, Gravitational field and potential, Calculations of gravitational potential and field – spherical shell & solid sphere, Physics of Oceanic tides, explanation of $1/r^3$ dependence. **(8 Hours)**

Self Study: Satellite in a circular orbit - Launching of artificial satellites, escape velocity, time period of a satellite. Geostationary, Geosynchronous satellites **(2 hours)**

5. Elasticity: Rigid bodies & elastic bodies, Concept of stress & strain, stress – strain diagram for metallic wire, elastic limit, Hooke's law, elastic moduli –Young's modulus, rigidity modulus & bulk modulus, Poisson's ratio, Mention the relation between them, limiting values of Poisson's ratio. Work done in stretching a wire(derivation), Bending of beams – concept of neutral surface and neutral axis, bending moment(derivation), theory of single cantilever. Torsion of a cylinder- Couple per unit twist.

6. **Surface tension:** Molecular forces in liquids & liquid surfaces – Adhesive & cohesive forces, Mention of sphere of influence, Molecular interpretation of surface tension. Surface energy – definition and derivation, angle of contact, lotus effect. Pressure difference across a curved surface (derivation), Excess of pressure inside a liquid drop and a bubble. Interfacial tension – drop weight method - balancing condition. (**13 Hours)**

Self study:

Viscosity: Streamline flow, turbulent flow, critical velocity, Reynold's number, equation of continuity and Stoke's method, life at low Rynold's number. **(2 hours)**

Course Outcomes

At the end of this course, students will be able to

- learn fixing units, tabulation of observations, analysis of data (graphical/analytical)
- learn about accuracy of measurement and sources of errors, importance of significant figures.
- Analyze the motion of particles under central forces.
- Analyze and apply the mechanics of orbital motion using Newton's law of gravitation.
- come to know how various elastic moduli can be determined.
- measure surface tension and viscosity and apply suitable method to the problem
- get hands-on experience of different equipment.

Text Book:

1. Physics for Degree Students, B.Sc First Year, C.L. Arora and P.S. Hemne, II edition, 2013, S. Chand and Company Ltd.

Reference Books:

1. University Physics with modern physics, Sears and Zemansky, 12th Edition, 2009, Pearson Education.

2. Mechanics, D.S. Mathur, S. Chand and Company Ltd. 2000.

3. Mechanics Berkeley Physics Course, Vol.1, Charles Kittel, 7th edition, Tata McGraw- Hill, 2007.

4. Properties of Matter, Brijlal & Subramanyam, S. Chand and Company Ltd. 2002.

5. Rotation, Scientific America, compilation of scientific paper. (Reference for conservation of angular momentum)

6. Life at lower Reynolds number, E.M. Purcell, American Journal of Physics 45, 3 (1977); https://doi.org/10.1119/1.10903.

7. Fundamentals of Physics, Resnick, Halliday & Walter, Wiley, 2002.

8. Newtonian Mechanics, A.P. French, WW Norton & Co.

9. Classical Mechanics, Rana and Jog, Tata Mc-Graw-Hill, 24th Edition, 1991

Practical I

PH 1P24: Practical

List of experiments.

Introduction to measuring devices (significant digits) and error analysis.

1. Determination of moment of inertia of a Fly Wheel.
2. Verification of parallel and perpendicular axis theorems.
3. Determine the Young's Modulus by bar bending method (single cantilever)
4. Viscosity by Stoke’s method
5. Surface tension and interfacial tension by drop weight method.
6. Moment of inertia of irregular body.
7. Rigidity modulus by dynamic method
8. Searle’s double bar
9. Bulk modulus of rubber
10. Verification of conservation of energy

Course Outcomes and Course Content

Semester	II
Paper Code	**PH 224**
Paper Title	**Thermal and Statistical Physics**
Number of teaching hours per week	03
Total number of teaching hours per semester	45
Number of credits	03

Objective of the Paper:

To make the students understand and learn the basic concepts of Thermodynamics and Statistical mechanics in detail which makes a firm basis for the advanced topics taught in higher semesters. The paper gives a detailed overview of Thermodynamics and Statistical mechanics with real time applications.

Semester- II

PH224 -THERMAL AND STATISTICAL PHYSICS

1. **Kinetic theory of gases:**

Kinetic theory of gases: Assumptions of kinetic theory of gasses, Deduction of the pressure of an ideal gas, Deduction of Boyle's law, Maxwell's velocity distribution (Graph & interpretation without derivation), Definition & expressions for rms, mean & most-probable velocity. Degrees of freedom, Principle of equipartition of energy, ratio of specific heat capacity for mono-atomic, di-atomic & tri-atomic gas. Mean free path (Derivation). Transport phenomenon – derivation of coefficient of viscosity. (**9 hours)**

Self Study: Charles's law & Avogadro's law from kinetic theory. **(1 hour)**

2. **Real gases:**

Andrew's isothermal curves for real gases, Van-der-Waals' equation, critical constants. Joule Thomson expansion- porous plug experiment with theory. **(5 Hours)**

3. **Thermodynamics:**

Zeroth law, First law of thermodynamics, Concept of internal energy, Concept of absolute zero, Entropy & second law of thermodynamics. Different types of thermodynamic processes: isothermal, adiabatic, isobaric & isochoric. Derivation of PV^{γ} = constant. Expressions for change of entropy- for phase transition and change in temperature. Statement of Clausius inequality, T-S diagram & its use to find the efficiency of Carnot cycle. Third law of thermodynamics. **(7 Hours)**

Self Study: Work done during isothermal & adiabatic changes. Carnot cycle, Carnot engine – efficiency. Carnot's theorem (Statement & explanation), thermodynamics of rubber band. **(3 hours)**

4. **Thermodynamic potentials:**

Internal energy, enthalpy, Helmholtz free energy, Gibbs free energy & their significance, Maxwell's thermodynamic relations from thermodynamic potentials & their significance. Application of Maxwell's thermodynamic relation – nature of variation of internal energy with volume, Clausius – Clayperon's equation. **(5 Hours)**

5. **Radiation:**

Black body radiation, Characteristics of black body spectrum, Planck's law with derivation, Deduction of Wien's displacement law & Rayleigh – Jean's law from Planck's law, Stefan's law, Stefan – Boltzmann law. Solar constant, Surface temperature of sun - derivation. **(5 Hours)**

Self Study: Bolometer and Bolometric measurements.

6. Statistical physics:

Fundamental Postulates of Statistical Mechanics- phase space, microstate, macrostate, thermodynamic probability. Maxwell Boltzmann statistics- basic postulates, distribution function. Bose Einstein statistics – postulates, distribution function, Fermi-Dirac statistics, and Fermi distribution function, Comparison of three statistics, Partition function, mention about the gas laws from partition function (no derivation). **(8 hours)**

Self study: Gas laws from partition function, width of spectral line (Collision broadening), Maxwell distribution of molecular velocities. (**2 hours)**

Course Outcomes:

Students will be able to

- Comprehend the assumptions of kinetic theory of gases and derive pressure of an ideal gas and deduce the gas laws.
- Interpret the Maxwell's velocity distribution and calculate RMS, Mean and Most probable velocity.
- Apply the principle of equipartition of energy to determine specific heat capacities, mean free path and coefficient of viscosity.
- understand Andrew's isotherms for real gases, their behavior under Van-der-Waals' conditions, and the calculation and interpretation of critical constants.
- learn an in-depth explanation of the Joule-Thomson expansion process and analyze its effects on real gases.
- Understand the Zeroth and First laws of thermodynamics and internal energy, analyze various processes, and derive the relationship between constants (P, V, γ).
- Know the foundation and application of the ideas of thermodynamic cycles to understand Carnot cycle, entropy, and the Third Law of Thermodynamics.
- Appreciate the relation between thermodynamic potentials and thermodynamic variables through Maxwell's thermodynamic relations.
- Grasp a fundamental understanding of the black body spectrum and the laws that regulate it to compare the behavior of any hot object, including the sun.
- learn about phase-space, concept of ensemble, ergodicity and various distribution functions based on the distinguishability of particles.

Text book:

1. Physics for Degree Students, B. Sc second year – C.L. Arora and P.S. Hemne, II revised edition 2013.

Reference:

1. Heat & Thermodynamics – J.B.Rajam.
2. Heat & Thermodynamics – D.S.Mathur – S Chand & Co – New Delhi, 5th Edition, 2004.
3. Teach Yourself Thermodynamics – Bharathibavan Publication.
4. Heat Thermodynamics & Statistical Physics – Brijlal, Subramanyam & P.S. Hemne, S Chand & Co.
5. Thermodynamics and Statistical Physics - Singhal, Agarwal.
6. Statistical and Thermal Physics: An Introduction, S. Lokanathan and R.S. Ghambir, I Edition, Prentice Hall India Learning Private Limited, 1991.
7. Fundamentals of Statistical and Thermal Physics, VI edition, Waveland Press, 2010.
8. Statistical Mechanics - M. Eisner B K Agarwal, New age international Pvt Ltd, 2020.
9. PSSC Physics, Gardner Robert, Kendall Hunt Pub Co, 1991.
10. Bose and his statistics, G. Venkatraman, Sangam Books Lte, 1993.

Continuous Assessment	
Assessment	**Marks**
Activity-1	10
Activity-2	10
Mid-Semester Exam	20
Total	40

Practical II

PH 2P24: Practical
List of experiments:

1.Determination of Specific heat of water using Joule's calorimeter.
2. Determination of Thermal conductivity of rubber.
3. Determination of Thermal conductivity of a bad conductor.
4. Determination of Emissivity of a surface by Lee's disc method.
5. Verification o of Stefan's constant by Emissivity method.
6. Newton's Law of cooling.
7. Black body radiator- determination of Stefan's constant.
8. Gaussian distribution – using radioactive source.
9. Entropy of latex rubber band (ref: Thermodynamics of a rubber band, American Journal of Physics)
10. Galton Board experiment- to demonstrate statistical distribution.

Course Outcomes and Course Content

Semester	III
Paper code	PH325
Paper Title	Simple Harmonic Motion, Waves and Oscillations
Number of teaching hours per week	3
Total number of teaching hours per semester	45
Number of credits	3

Objective of the paper

The objective of the course "Simple Harmonic Motion, Waves, and Optics" is to provide students with a comprehensive understanding of the fundamental principles and applications of oscillatory and wave motion, optical phenomena, and their theoretical and practical implications. The course is designed to equip students with the skills to analyze simple harmonic motion, wave dynamics, superposition effects, and optical phenomena like interference, diffraction, and polarization. Additionally, it introduces the principles and applications of modern optical technologies, including lasers and fiber optics, fostering a strong foundation for further studies or practical work in physics and related fields.

Semester – III

PH325: Simple Harmonic Motion, Waves and Optics

Unit – I – Simple Harmonic Motion and Waves

1. **Simple Harmonic Motion**: Definition of Simple Harmonic Motion, Differential equation of simple harmonic motion, Solution of differential equation. Velocity and acceleration of a particle having simple harmonic oscillation, Energy conservation in SHM, Angular SHM. Composition of two SHM's – Lissajous's figures. Equation of motion of damped harmonic oscillation – critical damping, under damping and over damping (qualitative). **(6 Hours)**

   Self-Study: Forced oscillation – concept of resonance. (Origin of refractive index) View online content: Collapse of Tacoma-narrow bridge. **(1 Hour)**

2. **Wave Motion:** Characteristics of wave motion, progressive wave equation – different forms of wave equations, differential equation of wave motion. Phase of the wave – relation between phase difference and path difference. Dispersive and non-dispersive medium. Energy transmitted by a wave, Intensity and Power transmitted by a sine wave. **(3 Hours)**

3. **Superposition of Waves:** Concept of phase velocity, group velocity, and relation between them, Derivation of Vg = dw/dk. Fourier theorem, Fourier series, Evaluation of the Fourier coefficients, Fourier analysis of a square wave. (If square wave is above or below the X axis should be mentioned clearly) **(4 Hours)**

   Self-Study: Superposition of waves – beats(radio detections, heterodyne) **(1 Hour)**

Unit – II – Optics, Lasers and Fibre Optics

4. **Interference:** Various theories of light, Huygen's principle and construction of wavefront. Theory of interference – conditions for sustained interference. Young's double slit experiment, effect of thin film in one of the interfering beams, Interference at thin films (reflected system), theory of interference at a wedge and theory of Newton's rings.

   (6 Hours)

   Self-Study: Fresnel's biprism – distance between two virtual sources by shift method.

   (1 Hour)

5. **Diffraction:** Fresnel and Fraunhoffer diffraction, Fresnel half period zones – rectilinear propagation of light, Zone plate – construction and theory, comparison of a zone plate with a convex lens. Fraunhoffer diffraction – theory of single slit diffraction, theory of grating – normal incidence, oblique incidence, Discussion of dispersive power – Grating, Rayleigh's criterion for resolution, resolving power of a grating (no derivation). **(7Hours)**

6. **Polarisation:** Review of Polarisation of light and methods of polarisation, plane of polarisation, Polarisation by reflection – Brewster's law, Malus law with proof. Huygen's theory of double refraction in uniaxial crystal, (mention as – Normal incidence, optic axis being perpendicular to the paper) birefringence, theory of retarding plates, quarter and half wave plates, production and detection of plane, circularly and elliptically polarised light. Optical activity, specific rotation, Fresnel's theory of optical rotation. **(6 Hours)**

   Self-Study: Applications of Polarised light - stress induced birefringence, Polaroid, optical isolator.

   (1 Hour)

7. **Lasers:** General principles – Spontaneous and stimulated emission, Einstein's A and B coefficients, monochromaticity, coherence and directionality, spatial and temporal coherence, spectral energy density, Condition for laser action – population inversion, metastable states, optical pumping, lasing, construction and working of He-Ne laser with energy level diagrams. **(3 Hours)**

   Self-Study: Applications of lasers, tunable lasers - organic dye lasers**,** optical parametric oscillators. **(1 Hour)**

8. **Fibre Optics:** Description of optical fibre – principle and construction, Expressions for acceptance angle and numerical aperture (NA), Fractional index change (Δ) and relation between NA and Δ, Types of optical fibre (w.r.t refractive index) – single mode and multi-mode, step-index mode and graded index mode. Modes of propagation (Qualitative), V- number. Mechanisms of energy loss in optical fibre, attenuation. **(4 Hours)**

   Self-Study: Applications of optical fibre – communication and medical field. **(1 Hour)**

Textbooks				
Sl No	**Title of the Book**	**Authors Name**	**Publisher**	**Year of Publication**
1.	Waves and Oscillations	N Subramanyam and Brij Lal	Vikas Publishing House Pvt. Ltd., Second Revised Edition	2010
2.	Optics	Ajoy Ghatak	McGraw Hill Education (India) Pvt Ltd	2017
3.	A text Book of Optics	Brij Lal, M N Avadhanulu & N Subrahmanyam	S. Chand Publishing	2012

References Books				
Sl No	**Title of the Book**	**Authors Name**	**Publisher**	**Year of Publication**
1.	Berkeley Physics Course – Waves,	Frank S Crawford Jr.	Tata Mc Graw-Hill Publishing Company Ltd., Special Indian Edition,.	2011
2.	Optics	Eugene *Hecht*	Pearson Paperback	2019
3.	Introduction To Optics	Pedrotti and Frank L ,	Pearson India	3rd Edition
4.	Fundamentals of Optics	Francis Jenkins Harvey White	McGraw Hill Education	2017
5.	Waves and oscillations	AP French	New York : Norton	1970
6.	The Physics of and Oscillations, Waves	N K Bajaj	Tata McG Publishing Compa Second Edition,	1984
7.	Oscillations and Wa	Satya Prakash	Pragathi Prakashan Second Edition	2003

Continuous Assessment	
Assessment	**Marks**
Activity -1	10
Activity 2	10
Mid semester Exam	20
Total	40

Practical III

PH 3P25: Practical

List of experiments:

1. Frequency of a tuning fork using a volume resonator
2. Frequency of AC using sonometer
3. Frequency of tuning fork using Melde's apparatus
4. Air-wedge experiment
5. Newton's rings
6. Diffraction grating – minimum deviation
7. Polarimeter – measurement of angle of specific rotation
8. To determine the focal length of combination of lenses
9. To determine the wavelength of laser using a plane diffraction grating
10. To determine the numerical aperture of the optical fibre
11. Fourier analysis of a square wave using LC circuit.
12. To determine Q factor using damped oscillator.

Course Outcomes:

- Upon completing **this course**, students will understand the principles of **Simple Harmonic Motion (SHM)**, including its mathematical representation, energy conservation, and applications. They will analyze **wave motion**, derive the wave equation, and explore concepts like phase difference, intensity, and energy transmission.
- The course enables students to apply the **superposition principle**, understand Fourier series, and analyze periodic waveforms such as square waves. In **optics**, students will study interference, diffraction, and polarization, including their theoretical foundations and practical applications.
- They will gain insights into **laser physics**, learning about spontaneous and stimulated emission, population inversion, and the working of a He-Ne laser.
- The course also introduces **fiber optics**, covering principles, construction, and applications in communication and medical fields. Overall, students will develop a strong foundation in oscillations, wave mechanics, and optical physics, preparing them for further studies and practical applications.

Course Outcomes and Course Content

Semester	IV
Paper code	PH425
Paper Title	Electricity and Magnetism
Number of teaching hours per week	3
Total number of teaching hours per semester	45
Number of credits	3

Objective of the paper:

The course outcomes (COs) aim to equip students with a comprehensive understanding of fundamental concepts in electromagnetism and electric current. Students will demonstrate proficiency in applying Gauss's law and Coulomb's law to analyze electric fields generated by point charges and charge distributions in various geometries. They will differentiate between vector (electric fields and Coulomb's law) and scalar (electric potential and potential energy) approaches in electrostatics. Students will apply Gauss's law to solve diverse problems and describe magnetic fields produced by magnetic dipoles and electric currents. They will articulate the relationship between electric and magnetic fields using Faraday-Lenz and Maxwell's laws and explain the origins and effects of magnetism with real-world examples. Additionally, students will analyze AC circuits using Kirchhoff's rules and describe the relationships involving resistance, capacitors, and inductors.

Semester – IV

PH425: Electricity and Magnetism

Unit – I – Electrostatics

1. **Scalar and Vector fields:** The Del operator, Gradient of a scalar field, divergence and curl of a vector - geometrical and physical interpretation, product rule of Del operator, and second derivatives. Line integral - conservative nature of the electrostatic field, surface and volume integrals - physical interpretation, flux over a vector field, Gauss divergence theorem, and Stokes curl theorem (statement).

   (4 Hours)

2. **Electric charge and field:** Coulomb's law, electric field strength, electric field lines, electric potential due to a point charge, Relation between field and potential (E = - Del V), Electric dipole - electric potential and field at any point due to a dipole. Potential due to electric quadrupole (qualitative). Constant potential surfaces.

   (4 hours)

3. **Gauss' law:** Gauss' law in integral and differential form, Poisson's equation and Laplace's equation, Applications of Gauss law - electric fields of (i) spherical charge distribution, (ii) line charge, and (iii) an infinite flat sheet of charge. Force on the surface of a charged conductor, electric pressure, and energy density.

   (5 hours)

   Self-Study: Potential due to distribution of charges (Examples: potential associated with a spherical charge distribution, infinite line charge distribution, infinite plane sheet of charges) **(2 hours)**

Unit II – Electricity

4. **Capacitors:** Capacitance of a parallel plate capacitor, parallel plate capacitor with dielectric (fully and partially filled), Energy stored in a capacitor, and Energy loss due to sharing of charges in capacitors. **(3 hours)**

5. **Magnetostatics and Electromagnetic Induction:** Lorentz force, Biot-Savart's law, force on a current-carrying conductor in a magnetic field, Torque on a current loop, the equivalence of a current loop and a magnetic dipole. Magnetic field due to solenoid. Ampere's circuital law statement and its application to an infinite straight conductor. Hall effect in metals.

   Faraday's laws and Lenz's law, energy stored in an inductor, self-induction - self-inductance of a long solenoid, energy density in a magnetic field, mutual induction - expression for mutual inductance between two coils, Eddy current. **(7 hours)**

6. **Transient (variable) currents:** Growth and decay of charges in RC, LR, and LCR circuit (qualitative discussion of different conditions in LCR). **(4 hours)**

   Self-Study: Currents and voltage in pure R, L and C circuits **(2 hours)**

7. **AC Circuits:** LCR series and parallel circuits (L & R in series and C in parallel) by vector method, applications in tuning circuits, resonance, sharpness of resonance, Q-factor, bandwidth, the expression for the power in an AC circuit, power factor, wattless current. The phase relation between voltage and current in R, L, and C.

   (5 hours)

   Self Study: Magnetic field due to circular coil (at the center and along the axis), principle of Helmholtz Tangent Galvanometer. 'Faraday law teaser' – AJP paper.

   'what does an AC voltmeter measure' – research article. **(2 hours)**

8. **Electromagnetic waves:** Electric displacement vector, Concept of displacement current, equation of continuity, setting up of Maxwell's equations & their physical significance, derivation of e.m. wave equation, the velocity of e.m. waves in free space and in an isotropic dielectric medium. Relation between electric and magnetic vectors - transverse nature, phase relation between electric and magnetic vectors, Poynting vector and energy density of e.m. waves. Skin effect. **(7 hours)**

Text Books

1. Electricity and Magnetism, R. Murugesan, S. Chand and Co, 2000.
2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education, lndia

Reference books:

SI No	Name of the Book	Authors Name	Publisher	Year of Publication
1	Physics-Part-1,	David Halliday and Robert Resnick	Wiley Eastern Limited	2001
2	Berkeley Physics Course, Vol-2, Electricity and Magnetism, Special Edition	Edward M Purcell	Tata Mc Graw-Hill Publishing Company Ltd, New Delhi	2008
3	Fundamentals of Electricity and Magnetism	B.D. Duggal and Chopra	S. Chand and Co	1986

4	Electricity and Magnetism.	K.K. Tiwari, S	Chand & Co	1995.
5	Vector analysis, Scheme Series, 2nd Edition,	Murray R.	McGraw-Hill Education	2000
6	Electricity and Magnetism	Sehgal, Chopra and Sehgal	S. Chand and Co.	2020

Continuous Assessment	
Assessment	**Marks**
Activity-1	10
Activity-2	10
Mid-Semester Exam	20
Total	40

Practical IV

PH 4P25: Practical

List of experiments:

1. Variation of electrical conductivity with temperature in Metals
2. Variation of electrical conductivity with temperature in Semiconductors
3. Charging and discharging of a capacitor (energy dissipated during charging and time constant measurements
4. Series resonance circuits (LCR circuits)
5. Parallel resonance circuits (LCR circuits)
6. Determination of self-inductance of a coil
7. Impedance of series RC circuits- determination of the frequency of AC
8. Black box -Identification of circuit elements and measurement of their values.
9. de-Sauty's bridge- verification of laws of combination of capacitors
10. RC circuit- determination of resistance by charging method.
11. Mapping of equipotential surfaces using Electrolyte solutions (NaCl or KCl)
12. RC filters. (Low pass, high pass and band pass)
13. Terminal velocity of magnets – Lenz law verification.
14. Mutual inductance and Skin effect demonstration.

Course Outcomes:

- Upon completing **this course**, students will understand the fundamental concepts of **electrostatics**, including Coulomb's law, electric fields, and potential. They will apply **Gauss' law** to solve problems involving charge distributions and analyze Poisson's and Laplace's equations.
- The course covers **capacitors and magnetostatics**, enabling students to calculate capacitance, understand energy storage, and apply Biot-Savart's and Ampere's laws to magnetic fields. Students will explore **electromagnetic induction**, including Faraday's and Lenz's laws, self-induction, and mutual induction, along with their real-world applications.
- They will analyze **AC circuits**, studying resonance, power factor, and phase relationships in LCR circuits.
- The course also introduces **Maxwell's equations and electromagnetic waves**, helping students understand displacement current, wave propagation, and energy transfer via the Poynting vector.
- Overall, students will develop a strong foundation in electricity, magnetism, and electromagnetic theory, preparing them for advanced studies and practical applications.