SEP

I SEMESTER
PHYSICS
DSC1-PHY104T: MECHANICS AND PROPERTIES OF MATTER
(Credits: Theory-04) 48 Hrs

Programme Outcomes

PO-1: Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
PO-2: Problem solving: Executeasolutionprocessusingfirstprinciplesofsciencetosolve problems related to respective discipline.
PO-3: Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
PO-4:Ethics: Apply the professional ethics and norms in respective discipline.
PO-5: Individual and team work: Work effectively as an individual as a team member in a multidisciplinary team.
PO-6: Communication: Communicate effectively with the stakeholders, and give and receive clear instructions.

Course Outcome: On successful completion of the course, the student willable to:

a) Learn about inertial, non inertial frames Galilean Transformations.
b) Know how "g" can be determined experimentally and derive satisfaction.
c) Lean distance between simple and torsional pendulum and their using the determination various physical parameters.
d) Know how various elastic moduli can be determined.
e) Will measure surface tension and viscosity and appreciate the methods adopted.

UNIT-1: FRAME OF REFERENCE (12 hrs)

Inertial frames, Galilean transformation equation (derivations), Invariance of Newton's laws under Galilean transformations, Invariance of the laws of conservation of momentum and energy under Galilean transformation, non-inertial Frames and Fictitious Force (In Brief). Rotating Frame of Reference, Concept of the Coriolis force and mention of its expression its expression.

DYNAMICS OF SYSTEM OF PARTICLES;

Center of mass – General expression; Newton's law for a System of particles; Linear momentum for a particle and a system of particles. Conservation of linear momentum-system with varying mass, Motion of rockets; velocity and acceleration of single-stage rocket and multi-stage rockets (qualitative), contribution and achievements of India in rocket technology(qualitative), Elastic and Inelastic collisions (only 2D) Problems.

UNIT-2: RIGID BODIES (12 hrs)

Rotational motion about an axis, Angular momentum, Relation between torque and angular momentum, Rotational energy. Theorem on moment of inertia: Perpendicular and parallel axis. Examples of moment of inertia: Moment of inertia of lamina, MI of Disc and MI of circular ring, Fly wheel, Theory of compound pendulum and determination of g by compound pendulum. Problems

UNIT-3: (12hrs)

Gravitation :

Newton's laws of gravitation. Motion of n particles in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's laws (statement only).Satellites in a circular orbit and applications. Geosynchronous orbits, weightlessness. Basic idea of global positioning system (GPS).

Elasticity

Hooks law-Stress-strain diagram-elastic moduli-relation between elastic constants-poisons ratio-expression for poisons ratio in terms of elastic constants-work done in stretching and work done in twisting a wire-twisting couple on cylinder-Determination of rigidity modulus by static torsion-Torsional pendulum.

UNIT-4: SURFACE TENSION AND VISCOSITY (12 hrs)

Surface tension: Review of basics of surface tension. Pressure difference across a liquid surface: Excess pressure inside a spherical liquid drop and excess pressure inside a soap bubble. Derivation of the relation between radius of curvature, Pressure and surface tension. Angle of contact: Case of two liquids in contact with each other and with air, Case of solids, liquid, and air in contact. Theory of rise of liquid in capillary tube.

Viscosity: viscosity of a liquid, Expression for co-efficient of viscosity, Expression for critical velocity, Significance of Reynolds's number. Derivation of Poiseuille's equation. Experimental determination of co-efficient of viscosity for a liquid by Poiseuille's method, Motion of a spherical body in a viscous medium: Expression for Co-efficient of Viscosity from stokes law.

Reference books:

1. Mechanics by D S Mathur
2. Mechanics by J C Upadhaya
3. Properties of matter by D S Mathur
4. Properties of matter by Brijilal and Subramanyam

SEP

II-SEMESTER
PHYSICS
DSC2-PHY204T: ELECTRICITY AND MAGNETISM
(Credits: Theory-04) 48 Lectures

Programme Outcomes

PO-1: Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
PO-2: Problem solving: Execute a solute on process using first principles of science to solve problems related to respective discipline.
PO-3: Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
PO-4: Ethics: Apply the professional ethics and norms in respective discipline.
PO-5: Individual and team work: Work effectively as an individual as a team member in a multidisciplinary team.
PO-6: Communication: Communicate effectively with the stakeholders, and give and receive clear instructions.

Course Outcome: On successful completion of the course, the student willable to:

a) Explain and differentiate the vector and scalar quantities.
b) Apply Gauss laws of electrostatics to solve a variety of problems.
c) Describe the magnetic field produced by magnetic dipoles and electric currents
d) Describe how magnetism is produced & list out the examples where its effects or observed. .

UNIT-1: **(12 Hrs)**

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence. Curt and their significance. Qualitative approach on Vector Integration. Line, surface and volume integrals of Vector fields. Gauss-divergence theorem and Stoke's theorem of vectors (statement only)

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere,. Electric potential as line integral of electric field, potential due to a point charge, Capacitance of an isolated spherical conductor. Parallel plate and spherical condenser. Energy per unit volume in electrostatic field. Dielectric medium. Polarisation. Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

UNIT-2 **(12 Hrs)**

Magnetic properties of Materials: Brief Introduction of dia-para-and ferro magnetic materials, Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, explanation of magnetic materials, paramagnetic susceptibility-Curie law, Hystereis loss of energy.

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Magnetism: Magnetostatics: Biot-Savart's law & its applications-straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic field and Force:- Magnetic force on a current carrying conductor, Hall effect and expression for Hall effect.

UNIT-3 (12 Hrs)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

Maxwell's equations and Electromagnetic wave propagation: Equation of continuity of current. Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum, transverse nature of EM waves, polarization.

UNIT-4 (12 Hrs)

DC Circuit analysis: Concept of current and voltage sources, Kirchoff's Current and Voltage law. Principle of Duality (voltage and Current sources equivalents). Thevenin's theorem, Superposition theorem, Reciprocity theorem and Maximum Power transfer theorem.

Transient Currents: Growth and decay of charge in RC circuit, Growth and decay of current in series LR circuit, decay of charge in series LCR circuit.

Alternating Currents: Review of basic definitions. LCR Series circuit to sinusoidal voltages, impedance by using only j operators –series resonance, Q factor and bandwidth – qualitative explanation of LCR parallel circuit.

Reference Books:

1. Electricity and Magnetism, D.C. Tayal, 1988, Himalaya Publishing House.
2. Introduction to Electrodynamics, D.J Griffiths, 3rd Edn, 1998. Benjamin Cummings.
3. Electric networks by B.L. Theraja
4. Electricity and Magnetism, K.K. Tiwari
5. Electricity and Magnetism, by Brij Lal and N Subrahmanyam.
6. Electricity and Magnetism, by Khare and Srivastava.

BIDAR UNIVERSITY, BIDAR DEPARTMENT OF STUDIES AND RESEARCH IN PHYSICS

SEP Syllabus for B.Sc. III Semester Physics

Curriculum Structruer for Undergraduate Programme for 2025-26

Effective from 2025-26 and onwards

DSC3-PHY303T: THERMAL PHYSICS AND STATISTICAL MECHANICS

(Credits: Theory-04) 4 hours per week, 60 Lectures

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Course Outcomes:

At the end of the course students will be able to understand

a) The law of thermodynamics
b) Thermodynamic description of the ideal gas and the ideas of entropy.
c) Radian, Energy distribution and various laws.
d) Understand the connections between microscopic and microscopic properties of the matter.

UNIT-I

Review of concepts of heat and temperature Laws of Thermodynamics: Thermodynamics Description of system Zeroth Laws of thermodynamics. First law and concept of internal energy, Conversion of heat into work. Various Thermodynamics Process, Application of First Law: General Relation between CP & CV, Work done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible process, Second law & Entropy, heat engine, Carnot's cycle (for its efficiency) & carnot theorems.

(15 Lectures)

UNIT-2

Thermodynamic Potentials: Enthalpy, Gibbs, Helmoholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thomson Effect, Clausius Clapeyron Equation, Expression for (CP-CV), CP/CV, Tds equations, Refrigerator, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Un attainability of absolute Zero.

(15 Lectures)

UNIT-3

Kinetic Theory of Gases: Postulates of kinetic theory of gases. Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order),

Transport Phenomena: Viscosity, Conduction and Diffusion (with derivation), degree of freedom Law of equipartition of energy (no derivation) and its application to specific heat of gases for mono-atomic and diatomic gases.

(9 Lectures)

UNIT-4

Theory of Radiation Blackbody: Blackbody radiation, Spectral distribution, Concept of energy Density. Derivation of Planck's law, Deduction of Wien's distribution law, Rayleign-Jeans law. Stefan Boltzmann Law and Wien's displacement law from Planck's law.

(6 Lectures)

UNIT-5

Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamics probability, Statistical equilibrium, Maxwell-Boltzmann distribution law- distribution of velocity mean, RMS and most probable velocities-Quantum statistics - Fermi-Dirac distribution law electron gas-Bose-Einstein distribution law-photon gas-comparison of three statistics.

(15 Lectures)

Reference Books:

- Thermal physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGram-Hill.
- A Treatise on heat, Meghnad Saha, and B.N .srivastava, 1969, Indian Preaa.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M.W.Zemasky and R.Dittman.1981.McGraw Hill 14.
- Thermodynamics, Kinetic theory & Statistical thermodynamics,F.W sears & G.L.Salinger 1938 Narosa.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A.Kumar and S.P.Taneja,2014, R. Chand Publication.
- Heat, Thermodynamics and statistical mechanics by Brijlal and Subramanyam.
- Heat Thermodynamics and Statistical physics by Singhal, Agrwal and Singhal.
- Engineering Physics by Gour and Gupta.
- Statistical Mechanics by Satyaprakash.
- Statistical mechanics by Gupta, Kumar and Sharma.

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BIDAR UNIVERSITY, BIDAR DEPARTMENT OF STUDIES AND RESEARCH IN PHYSICS

SEP Syllabus for B.Sc. III Semester Physics, Elective paper – 1
Curriculum Structruer for Undergraduate Programme for 2025-26
Effective from 2025-26 and onwards
DSC-PHY304E1: Optical Instruments
(2 credits 2 hours per week)

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Course learning objectives

COURSE OUTCOMES:

At the end of the course students will able to

1. Understand the principle of optics, design and use of optical instruments and supply their knowledge to solve real-world problems.
2. Understand the construction, working principles and applications of various optical instruments like telescope, microscope, spectrometers, interferometer and diffraction and grating.

Unit 1: Basics of Optics

Scope of optics, optical path, laws of reflection as per Fermat's Principle, magnifying glass, Lenses: convex and concave lenses, Lens maker's formula for double concave and convex lenses, Focal and nodal points, focal length, image formation, combination of lenses, Dispersion of light. (10 Hours)

Unit 2: Camera and microscopes

Structure and human eye, photographic camera (Principle, construction and working), simple microscopes, Simple, compound and electron microscopes (construction and working principle). Study of binocular. (10 Hours)

Unit 3: Telescope and Spectrometer

Construction and working principle of Astronomical, terrestrial and reflecting telescopes, construction and working principle of Eyepieces; (Huygens and Ramsden Eyepieces), construction working and applications of Spectrometer. (10 Hours)

BIDAR UNIVERSITY, BIDAR DEPARTMENT OF STUDIES AND RESEARCH IN PHYSICS

SEP Syllabus for B.Sc. III Semester Physics, Elective paper – 2
Curriculum Structruer for Undergraduate Programme for 2025-26
Effective from 2025-26 and onwards
DSC-PHY304E2: Astronomy
(2 credits 2 hours per week)

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Course learning objectives

COURSE OUTCOMES:

At the end of the course students will able to

1. Learn about ancient, Indian and modern astronomy.
2. Learn about optical instruments used for a study of astronomical objects
3. Understand about Sun and Moon their dynamics.

Unit 1: History and introduction of astronomy.

Ancient Astronomy: Greek observations, Sumerian observation, Mayan Observation, Arabic observation, Chinese observation. **Indian Astronomy**: Vedic astronomy, ancient astronomy- Aryabhata, Varahamihira, Bhaskar. Astronomy in Indian Scriptures, precession of the Equinox, Celebration of equinox. **Medieval & Modern Astronomy:** Invention of telescope, models of the solar systems and universe observations by Tycho Brahe, Kepler, Herschel, Galileo and others, modern astronomy. **Optical tools for a Astronomy:** Pin Hole, Binoculars, telescope and imaging. **Mathematical methods of observations:** Angular measurement, Trigonometric functions. Stellar Parallax. (15 hours)

Unit 2: Observations of the Solar system.

The sun: Ecliptic and orientation of the earth, seasons – Solstices and equinox, Observations of the sun from earth during seasons, Eclipses, zero shadow day, sunspots. **The Moon:** Earth-moon system - phases, lunar eclipses. Ecliptic and lunar optical plane - nodes; lunar month, full moon names. **Inner planet:** Mercury and Venus, observational history, observational windows, Appearances, Apparitions, Elongation, Superior conjugations, inferior conjugations, transits. (15 hours)

BIDAR UNIVERSITY, BIDAR DEPARTMENT OF STUDIES AND RESEARCH IN PHYSICS

SEP Syllabus for B.Sc. IV Semester Physics
Curriculum Structruer for Undergraduate Programme for 2025-26
Effective from 2025-26 and onwards
DSC4-PHY403T: WAVES AND OPTICS
(Credits: Theory-04) 4 hours per week, 60 Lectures
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COURSE OUTCOMES:

At the end of the course students will

1. Gain the Knowledge to apply key concepts related to wave phenomena, wave properties, wave nature of light.
2. Be able to differentiate phenomena like interference, diffraction and polarization.
3. Gain practical skills in experimental design, measurement and error analysis, particularly through laboratory exercises involving optical instruments.
4. Identify and describe methods of producing polarized light.

UNIT 1: WAVES & SUPERPOSITION OF HARMONIC WAVES **[15 Hours]**

Plane and spherical waves, longitudinal and transverse waves, characteristics of wave motion plane progressive (travelling) wave and its equation, wave equation-differential form (derivation) particle and wave velocities. Relation between them, energy transport, expression, for intensity of progressive wave, Newton's formula for velocity of sound. Laplace's correction (derivation). Brief account of Ripple and Gravity waves.

Linearity and superposition principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (beats). Analytical treatment, superposition of two perpendicular harmonic oscillations. Lissajous figures with equal and unequal frequency. Analytical treatment, uses of Lissajous figures.

UNIT-II : STANDING WAVES & ACOUSTICS **[15 Hours]**

Standing waves: Velocity of transverse waves along a stretched string (derivation). standing (stationary) waves in a string. Fixed and free ends (qualitative). Theory of normal modes of vibration in a stretched string, energy density and energy transport of a transverse wave along a stretched string. Vibration in rods longitudinal and transverse modes (qualitative). Velocity of longitudinal waves in gases (derivation). Normal modes of vibrations in open and closed, pipes analytical treatment. Concept of resonance, theory of Helmholtz resonator.

Absorption coefficient, reverberation and reverberation time, Sabine's reverberation formula (derivation), factors affecting acoustics in buildings, requisites for good acoustics. Acoustic measurements, intensity and pressure levels.

UNIT – III: NATURE OF LIGHT

[15 Hours]

The corpuscular model of light. The wave model, Maxwell's electromagnetic waves. Wave particle duality.

Interference of Light By Division Of Wave Front: Huygen's theory-concept of wave front, Interference pattern produced on the surface of water-coherence. Interference of light waves by division of wave front Young's double slit experiment, derivation of expression for fringe width. Fresnel Bi-prism interference with white light.

Interference of Light By Division Of Amplitude: Interference by division of amplitude. Interference by a plane parallel film illuminated by a plane wave - interference by a film with two nonparallel reflecting surface colour of thin films. Newton's rings (reflected light) Michelson interferometer determination of wavelength of light.

UNIT – IV: DIFFRACTION AND POLARISATION

[15 Hours]

Fraunhofer Diffraction: Fraunhofer diffraction, single slit diffraction pattern - position of maxima and minima (qualitative arguments), two slit diffraction pattern -position of maxima and minima. Theory of plane diffraction grating-grating spectrum - normal and oblique incidence. Resolving power and dispersive power of a grating single slit, double slit, multiple slits and diffraction grating. 5Hrs

Fresnel Diffraction: Fresnel half period zones, diffraction by a circular aperture –diffraction by an opaque disc - The zone plate - comparison between zone plate and convex lens. 5Hrs

Polarisation: Introduction - production of polarized light. The wire grid polarizer and polaroid - Superposition of two disturbances. Phenomenon of double refraction Quarter wave plates and half wave plates. Analysis of polarized light Optical activity. 5Hrs

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Reference Books:

- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw- Hill
- Principles of Optics, B. K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati D.R Khanna, 1991, R Chand Publication
- University physics. FW Sears, MW Zemansky and HD young 13/e, 1986 Addison – Wesley
- A text book of Optics, Brijlal M N, Avadhanulu & N Subramanyam, 2012, S Chand Publication
- Oscillations and Waves, Satyaprakash, 2003, Pragati Prakashan, Meerut.
- A text book of Sound, D R Khanna and R S Bedi, 1952, Atma Ram & Sons,
- The Physics of waves and oscillations, N K Bajaj, 1984, Tata McGraw- Hill publishing company Ltd.
- Optics, Ajoy Ghatak McGraw Hill Education (India) Pvt. Ltd.

BIDAR UNIVERSITY, BIDAR DEPARTMENT OF STUDIES AND RESEARCH IN PHYSICS

SEP Syllabus for B.Sc. V Semester Physics

Curriculum Structruer for Undergraduate Programme for 2026-27

Effective from 2026-27 and onwards

DSC-5PHY: Condensed matter Physics, Classical Mechanics and Quantum Mechanics

(Credits: Theory-04) 4 hours per week, 60 Lectures

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COURSE OUTCOMES:

At the end of the course students will

1. Gain the Knowledge of Analysing crystal structures.
2. Be able to Evaluate diffraction patterns and Explain band theory
3. Understand superconductivity and Free electron theory of metals.
4. Be able to understand laws and principles of classical mechanics.
5. Be able to analyze Failure of Classical mechanics.
6. Be able to understand fundamental principles of quantum mechanics.

unit. 1: Crystal structure: **[15 Hours]**

Crystal structure Space Lattice, Lattice translational vectors, Basics of crystal Structure. Types of unit cells, primitive, non-primitive cells, seven crystal system coordination numbers, miller Indices, Expression for interplanar spacing. Production and properties of X-rays. X-Ray diffraction, Bragg's law, Bragg's X-ray spectrometer-powder diffraction methods: Structure of NaCl and diamond.

Unit. 2: Band theory of solids. **[15 Hours]**

Elementary ideas regarding formation of energy bands, Explanation of electrical conductivity of a conductor, semiconductor and an insulator. Intrinsic and extrinsic semiconductors. Derivation of expression for electrical conductivity.

Free electron theory of metals.

Classical free electron model, expression for electrical conductivity, thermal conductivity in metals. Wiedemann-Franz law.

Superconductivity.

Definition, experimental results - zero resistivity and critical temperature. The critical magnetic field- Meissner effect, Type I and Type II superconductors. Applications of superconductivity.

Unit3: Classical Mechanics **[15 Hours]**

Review of Newton's laws of Motion, Constraints (Holonomic, Non-holonomic, Scleronomic, and Rheonomic constraints with examples), Degrees of freedom, space point and configuration space, virtual displacement and principle of virtual work, generalized co-ordinates, generalized displacement, generalized velocity and generalized force, D'Alembert's Principle. Lagrange's equations, Importance of Lagrangian formulation, general expression for kinetic energy, Symmetries and the laws of conservation.

Unit4: Introduction to Quantum Mechanics **[15 Hours]**

Brief discussion on failure of classical physics to explain black body radiation, Photoelectric effect, Compton effect, stability of atoms and spectra of atoms.
Compton scattering: Expression for Compton shift (With derivation).
Matter waves: de Broglie hypothesis of matter waves, properties of matter waves. Experimental evidence for matter waves: Davisson- Germer experiment, G.P Thomson's experiment and its significance.
Heisenberg uncertainty principle: Elementary proof of Heisenberg's relation between momentum and position, energy and time, angular momentum and angular position, illustration of uncertainty principle by Gamma ray microscope thought experiment. Consequences of the uncertainty relations: Diffraction of electrons at a single slit, why electron cannot exist in nucleus?
Schrodinger wave equation: time dependent and time independent wave equation, physical significance of wave function. Application of Schrodinger wave equation. particle in a box solution for one dimension, extension to 3-dimantion, degeneracy, harmonic oscillator, zero-point energy.

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Reference Books.

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004. Wiley India Pvt. Ltd.
2. Elements of Solid-State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill.
4. Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
5. Introduction To Classical Mechanics by RG Takwale (S)
6. Quantum Mechanics, M. Mathews &Venkatesan
7. Solid State Physics by Dekker.
8. quantum mechanics by leonard i Schiff.