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KARMAVEER BHAURAO PATIL COLLEGE, URUN-ISLAMPUR

Department of Physics

(2025-26)

Course Outcome's

B.Sc. I Paper I: DSC-1 A MECHANICS	
CO1:	Students are able to understand and identify scalar and vector physical quantities in mechanics
CO2:	Students are able to understand and apply vector algebraic methods to elementary exercises in mechanics
CO3:	Students are able to understand and apply basic concepts of rotational motion
CO4:	In general, students are capable of correlating above concepts and methods in mechanics to both theoretical and experimental domains revealing analytical as well as numerical skills
B.Sc. I Paper I: DSC-2A ELECTRICITY & MAGNETISM-I	
CO1:	Students are able to understand the physical significance of gradient, divergence and curl
CO2:	Students are able to apply concepts in vector calculus such as gradient, divergence and curl related to vector and scalar fields using Gauss, Stokes and green`s theorem
CO3:	Students are able to understand and apply concepts of electrostatic field, potential to point charges, electric dipole and geometrically regular charged bodies
CO4:	Students are able to understand and apply concept of energy density in electric field
CO5:	Students are capable of applying above concepts to solve numerical exercise in electrostatics
B.Sc. I Sem-I: DSC- PHYSICS Practical -I :	
CO1:	Apply fundamental mechanical principles: Utilize concepts like moment of inertia, simple harmonic motion, and gravity to design and conduct experiments, analysing and interpreting results.

CO2:	Develop experimental skills: Demonstrate competence in setting up apparatus, taking precise measurements, and calculating uncertainties, understanding limitations and sources of error.
CO3:	Explore electrical components and circuits: Classify and characterize resistors, capacitors, and galvanometers based on their properties and roles in circuits, measuring resistance and magnetic field strength.
CO4:	Investigate wave phenomena and their interactions: Analyze the behavior of sound waves in different media (magnetic vs. non-magnetic), employing a sonometer to determine frequency and comprehend the influence of materialproperties.
B.Sc. I Paper III: DSC-1B PROPERTIES OF MATTER	
CO1:	Students are able to revise basic concepts such as stress, strain and elastic constants of elasticity
CO2:	Students are able to derive elastic constants for beam supported at both ends and at one end
CO3:	Students are able to derive elastic constant (eta) of a wire under torsional oscillations (Searle's Method)
CO4:	Students are able to explain the phenomenon of surface tension on the basis of molecular forces
CO5:	Students are able to derive the relation between surface tension and excess pressure
CO6:	Students are able to perform an experiment to determine ST by Jaeger`s method
CO7:	Students are able to discuss and state the factors affecting the ST
CO8:	Students are able to understand fluid dynamics and its applications
CO9:	Students are able to understand viscosity and experimental determination of coefficient of viscosity of liquid by Poiseuille's method
CO10:	Students are able to understand effect of temperature and pressure on viscosity of liquid
CO11:	In general, students are capable of correlating above concepts and methods to both theoretical and experimental domains revealing analytical as well as numerical skills
B.Sc. I Paper III: DSC-2B ELECTRICITY & MAGNETISM-II	
CO1:	Students are able to understand importance of complex numbers in analysis of AC Circuits contacting Inductance(L) Capacitor(C) and Resistance (R) and their various configurations
CO2:	Students are able to define and apply the concepts in AC circuits such as Impedance (Z), reactance (XC and XL), Admittance, Susceptance and Quality Factor (Q)
CO3:	Students are able to understand and design AC bridge: Owen`s Bridge

CO4:	Students are able to understand basic working principle of Ballistic galvanometer
CO5:	Students are able to define constants of ballistic galvanometer
CO6:	Students are able to understand the explain the phenomenon of hysteresis in magnetism
CO7:	Students are able to discriminate different magnetic materials based on their characteristic properties
B.Sc. I Sem-II: DSC- PHYSICS Practical -II	
CO1:	Master mechanical measurements and principles: Utilize advanced techniques like Poiseuille's method, bending, and vibration to measure viscosity, Young's modulus, and Poisson's ratio, demonstrating understanding of fluid dynamics and elasticity.
CO2:	Analyze surface tension and its impact: Employ Jaeger's method to investigate surface tension, recognizing its role in various phenomena and its dependence on Material properties.
CO3:	Explore AC circuits and impedance: Analyze the behavior of series and parallel LCR circuits, measuring impedance and comprehending the influence of Individual components (L, C, R) on resonance and phase relationships.
CO4:	Investigate bridge circuits and transformers: Utilize a B.G. bridge to determine unknown resistances and delve into the principles and applications of transformers, understanding their role in AC power transmission and voltage transformation

B.A. Part-I Semester I OE I: Household Electrical and Electronic Appliances-I (Practical)	
CO1:	Ability to correctly identify and represent **various electrical components & electronic components** and their **circuit symbols**.
CO2:	Skilled use of common laboratory tools such as **multimeter, cutter, different types of screwdrivers, testers, and soldering gun**.
CO3:	Ability to test and verify the working condition of **electrical components** & **electronic components**
CO4:	Ability to construct **series & parallel connections of resistances** and validate results experimentally.
CO5:	Understanding of the relationship between theoretical formulas (Ohm's Law, series and parallel resistance formulas) and **practical experimental observations**

B.A. Part-I Semester II OE II: Household Electrical and Electronic Appliances-II (Practical)	
CO1:	Ability to test and repair **electrical bells** and restore them to working condition.
CO2:	Ability to test and repair **electronic bells** with accurate fault detection.
CO3:	Competence in testing and repairing **decoration LED lamps and strings** with **series & parallel connection**.
CO4:	Ability to test and repair **battery (cell) torches** effectively. Ability to test and repair **emergency torches** – single light type. Ability to test and repair **emergency torches** – multilight type.
CO5:	Ability to test and repair **electronic toys, electronic watches, and remote controls**.
CO6:	Development of fault-finding techniques and step-by-step problem-solving approach for electrical and electronic devices.

B.Sc. Part-II SEM-III PHYSICS Paper-V (Major): Thermal Physics	
CO1:	Student understands basic laws of thermodynamics. Student is able to describe the laws of thermodynamics from both microscopic and macroscopic point of view. Student can also apply these laws to understand real physical systems.
CO2:	Students know the concept of heat engine and refrigerator. Students are able to compute efficiency of Carnot heat engine and coefficient of performance of refrigerator
CO3:	Student understands concept of thermal equilibrium. Students learn how to describe systems in thermal equilibrium using thermodynamics, kinetic theory of gases.
CO4:	Students understand theory of transport phenomena. Students are able to derive expressions related to transport of momentum, transport of thermal energy and transport of mass.
CO5:	Students understand the concept of fourth thermodynamic variable that is entropy. Students learn use of entropy to define third law of thermodynamics.
CO6:	Students know four thermodynamic potentials and are able to derive Maxwell's thermodynamic relations. They apply knowledge of Maxwell's equations to derive relations between specific heats.
B.Sc. Part-II SEM-III PHYSICS Paper-VI (Major): Waves and Optics	
CO1:	Understand the Fundamentals of Diffraction
CO2:	Utilize the plane diffraction grating to determine the wavelength of monochromatic light experimentally.

CO3:	Apply the Principles of Polarization and Analyze Interference Patterns.
CO4:	Explain interference in wedge-shaped films and derive the theory of Newton's rings.
CO5:	Correlate Resolving Power with Wave Optics.
B.Sc. Part-II Semester III **PHYSICS Practical –III (Major): Thermal Physics and Waves & Optics**	
CO1:	Develop the ability to **determine the coefficient of thermal conductivity** using **Searl's apparatus**.
CO2:	Gain skills to **measure the specific heat** of graphite accurately.
CO3:	Acquire the capability to **determine the temperature coefficient of resistance** using a **platinum resistance thermometer**.
CO4:	Gain proficiency in **determining temperature coefficient of resistance** with the help of a **P.O. box**.
CO5:	Understand and experimentally determine the **Joule constant (J)** by the **electrical method**.
CO6:	Experimentally determine the **mechanical equivalent of heat (J)** using **Callender and Barne's constant flow method**.
CO7:	Learn to measure the **viscosity of liquids** using **Searle's viscometer**.
CO8:	Learn the **calibration of a spectrometer** for precise optical measurements.
CO9:	Determine the **resolving power of a diffraction grating**.
CO10:	Measure the **wavelength of sodium light** using **Newton's Rings method**.
CO11:	Determine the **thickness of a thin film** using optical interference techniques.
CO12:	Measure the **wavelength of sodium light** using a **bi-prism**.
CO13:	Study and measure the **specific rotation of sugar** using a **polarimeter**.
CO14:	Determine the **wavelength of LASER light** using a **plane diffraction grating**
B.Sc. Part-II SEM-III PHYSICS Paper-V (Minor): Thermal Physics	
CO1:	Student understands basic laws of thermodynamics. Student is able to describe the laws of thermodynamics from both microscopic and macroscopic point of view. Student can also apply these laws to understand real physical systems.
CO2:	Students know the concept of heat engine and refrigerator. Students are able to compute efficiency of Carnot heat engine and coefficient of performance of refrigerator.

CO3:	Student understands concept of thermal equilibrium. Students learn how to describe systems in thermal equilibrium using thermodynamics, kinetic theory of gases.
CO4:	Students understand theory of transport phenomena. Students are able to derive expressions related to transport of momentum, transport of thermal energy and transport of mass.
CO5:	Students understand the concept of fourth thermodynamic variable that is entropy. Students learn use of entropy to define third law of thermodynamics.
CO6:	Students know four thermodynamic potentials and are able to derive Maxwell's thermodynamic relations. They apply knowledge of Maxwell's equations to derive relations between specific heats
B.Sc. Part-II SEM-III PHYSICS Paper-VI(Minor): Applications of Physics	
CO1:	Understand concepts of geometrical optics.
CO2:	Understand the production of Laser Light and its diverse significant applications.
CO3:	Know X-rays as diagnostic tools and nuclear phenomena in cure of dreadful disease.
CO4:	Know how to address or overcome the challenges of climate change.
B.Sc. Part-II PHYSICS Practical –III (Minor): Thermodynamics & Applications of Physics	
CO1:	Ability to record and analyse the **cooling curve of a hot object** as a function of time using a **thermocouple**.
CO2:	Skill in determining the **temperature coefficient of resistance** using a **platinum resistance thermometer**. Proficiency in determining the **temperature coefficient of resistance** using a **Post Office Box**.
CO3:	Ability to determine the **Joule's constant** by the **electrical method**. Understanding of **thermistors** and their application as **temperature transducers**.
CO4:	Ability to determine the **latent heat of fusion** of ice experimentally.
CO5:	Ability to measure the **thermal coefficient of linear expansion** of a metal rod

B.Sc. Part-II Vocational Skill Course –I (Practical): Skills in Physics	
CO1:	Handle and operate various instruments in Physics laboratory.
CO2:	Develop practical skill, instruments handling skills, observational skills.

B.Sc. Part-II SEM IV PHYSICS Paper-VII Major VII: Modern Physics	
CO1:	Understand the basic ideas of special theory of relativity like space and time are relative depending on the observer's motion. Fundamentally changing our perception of space and time depending on the reference frame.
CO2:	Develop critical understanding of dual nature of radiation by comprehending the Significant phenomena that turned to be the milestones in the development of modern physics.
CO3:	Explain the significance of matter waves that led to the invention of electron microscopy and also to quantify the uncertainty in the probabilistic measurements
CO4:	Understand the refinements in conventional atomic models that led to the modern vector atomic model. In future to develop an insight into atomic spectra exhibited by different elements.
B.Sc. Part-II SEM IV PHYSICS Paper-VIII (Major) : Analog & Digital Electronics	
CO1:	Student will be able to discuss the construction and working of CRO and various Applications of CRO and illustrate it with suitable examples.
CO2:	Student will be able to discuss single stage common emitter amplifier with ac and dc load line
CO3:	Student will be able to design different types of oscillator circuits of desired frequency
CO4:	Student will be able to list basic logic gates and derived logic gate.
CO5:	Student will be able to understand basics of Python programming language.
B.Sc. Part-II Semester IV PHYSICS Practical –IV (Major) Modern Physics and Analog & Digital Electronics	
CO1:	Able to perform experiments in Modern Physics and Electronics.
CO2:	Develop practical skill, instruments handling skills, observational skills and problem solving skills.
CO3:	Able to solve problems in Python programming language
B.Sc. Part-II Semester IV PHYSICS Minor VII: Semiconductor Physics	
CO1:	Explain the fundamental properties of semiconductors, distinguish between intrinsic and extrinsic semiconductors, and describe the behaviour of majority and minority carriers in a p-n junction.
CO2:	Analyse the properties of a p-n junction under forward and reverse bias and interpret the V-I characteristics of the junction.
CO3:	Demonstrate the ability to design and analyse rectifier circuits (half-wave, full-wave,and bridge), calculate ripple factors, and understand the role of filter circuits in reducing ripples. They will also evaluate the operation of a Zener diode as a voltage stabilizer.
CO4:	Students will understand the working principles of NPN and PNP transistors, explain the transistor configurations (CE, CB) and evaluate the characteristics of transistors in these configurations.

B.Sc. Part-II Semester IV PHYSICS Minor VIII: Astronomy & Astrophysics	
CO1:	Understand the fundamentals laws and theories of Astronomy.
CO2:	Discuss the star evolution and related basic concepts.
CO3:	Compare the characteristics of the Galaxy
CO4:	Explain various activities of the Sun.

B.Sc. Part-II Semester VI PHYSICS Minor Practical II: Semiconductor Physics and Astronomy & Astrophysics	
CO1:	Ability to study and interpret the **I–V characteristics** of a **p–n junction diode** in both forward and reverse bias.
CO2:	Understanding and analysis of the working of a **half-wave rectifier**. Understanding and analysis of the working of a **full-wave rectifier**. Ability to study the **output waveform of a bridge rectifier** with and without a **filter circuit**.
CO3:	Understanding the operation of a **Zener diode** as a **voltage regulator**.
CO4:	Ability to study and plot the **output characteristics** of a **transistor in common-emitter (CE) configuration**. Understanding the operation and performance of a **single-stage CE transistor amplifier**.
CO5:	Ability to verify the **inverse square law of intensity** using a **solar cell**. Understanding and interpretation of the **solar spectrum**.
CO6:	Ability to analyse **sunspot activity** and understand its significance. Skill in drawing and identifying **constellation maps** for Orion, Ursa Major (Big Dipper), Auriga, and Taurus.
CO7:	Application of the **parallax method** to determine large distances in space.
CO8:	Understanding and observation of **spherical aberration** through **caustic curve** patterns. Ability to study and interpret a **polar graph**.

SEC Practical –I: Physics Laboratory Techniques I	
CO1:	Handle and operate various instruments in Physics laboratory.
CO2:	Perform experiments in General Physics and Optics
CO3:	Develop practical skill, instruments handling skills, observational skills and problem solving skills
CO4:	Record experimental observations scientifically.

SEC Practical –II: Physics Laboratory Techniques II	
CO1:	Handle and operate various instruments in Physics laboratory.
CO2:	Perform experiments in Electronics.
CO3:	Record experimental observations scientifically.
CO4:	Solve problems in Python programming language.

B.Sc. Part-II Semester III OE Practical –III: Units & Measurements	
CO1:	Measure distance using given instruments.
CO2:	Do the calculation to find out value of physical quantities.
CO3:	Know the optical phenomena
CO4:	Understand physical units.

B.Sc. Part-II Semester IV OE Practical –IV: Physics of Everyday Life	
CO1:	Understand and Apply Basic Physical Concepts: Students will be able to understand and apply fundamental physics concepts.
CO2:	Conduct Simple Experiments: Students will be able to conduct basic experiments to measure physical quantities, observe phenomena, and collect data.
CO3:	Appreciate the Relevance of Physics: Students will be able to appreciate the relevance of physics in their daily lives and its applications in various fields.
CO4:	Develop Critical Thinking Skills: Students will be able to critically analyze and evaluate information related to physics and its applications

B.Sc. Part-III Semester-V **PHYSICS Paper-IX** **DSE-E1: Mathematical Physics and Classical Electrodynamics**	
CO1:	Identify order and degree of partial differential equation.
CO2:	Determine linear and nonlinear form of partial differential equation
CO3:	Solving Two dimensional Laplace's and Wave equation and Three dimensional Laplace's equation in Cartesian coordinate system by method of separation of variables
CO4:	Inspect second order linear differential equation to determine its singular point

CO5:	Describe the Motion of charged particle - in uniform electric field E, magnetic field B, Crossed uniform electric field E and magnetic field B..
CO6:	Solve problem related to Motion of charged particle - in uniform electric field E, magnetic field B, Crossed uniform electric field E and magnetic field B
B.Sc. Part-III Semester-V PHYSICS Paper-X DSE-E2: Quantum Mechanics	
CO1:	Use the Schrödinger equation, Heisenberg's uncertainty principle, and the Pauli principle to calculate and analyse systems that illustrate quantum mechanical phenomena.
CO2:	Solve examples to explain the quantization of energy, superposition, wave-particle duality, and tunnelling effect.
CO3:	Discuss the basic principles of quantum mechanics.
CO4:	Explain the operator formulation of quantum mechanics.
CO5:	Discuss the concept of wave function.
CO6:	Solve Schrodinger equation for simple potentials
B.Sc. Part-III Semester-V PHYSICS Paper-XI DSE-E3: Classical Mechanics	
CO1:	Define and understand basic mechanical concepts related to advanced problems involving the dynamic motion of classical mechanical systems.
CO2:	Explain about the forces, angular momentum and knowledge about the constraint.
CO3:	Compare and contrast the differential equations and other advanced mathematics in the solution of the problems of mechanical systems.
CO4:	Describe and understand the motion of a mechanical system using Lagrange- Hamilton formalism.
CO5:	Describe and understand the motion of the forces in non inertial systems.
CO6:	Recall inertial frame of reference, non-inertial frame of reference
CO7:	Apply Galilean and Lorentz transformations to frames of references.
CO8:	Construct expressions for time dilation, length contraction, variation of mass with velocity, mass energy equivalence using Special Theory of relativity.
CO9:	Discuss Michelson Morley Experiment.

B.Sc. III- Semester- V PHYSICS Paper XII DSE-E4: Digital and Analog Circuits and Instrumentation	
CO1:	List basic logic gates and Derived logic gate..
CO2:	Explain De Morgan's theorem and use of NAND and NOR gate as universal building blocks.
CO3:	Discuss single stage common emitter amplifier with ac and dc load line.
CO4:	Design different types of oscillator circuits of desired frequency
CO5:	Explain construction and working of CRO.
CO6:	Describe various applications of operational amplifier
CO7:	Solve problems related to calculation of frequency, time period, pulse width, duty cycle of IC-555 monostable and astable multivibrator.
B.Sc. III- Semester- VI PHYSICS Paper-XIII DSE-F1:Nuclear and Particle Physics	
CO1:	List Constituents of nucleus and their intrinsic properties , Quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number
CO2:	Discuss Need of accelerators, Cyclotron- construction, working, theory and its limitations, Principle of phase stable orbit, Synchrocyclotron - construction and working, Synchrotrons- electron synchrotron and proton synchrotron, Betatron - principle, construction and working condition
CO3:	Outline - construction, working and theory of Geiger Muller counter, Scintillation detector and photo-multiplier tube (PMT)
CO4:	Explain Semiconductor detector, Cerenkov radiations, Cerenkov detector.
CO5:	Classify elementary particles
CO6:	Inspect, Symmetries and conservation laws energy, momentum, angular momentum and parity, Baryon number, Lepton number of a elementary particle
CO7:	Discuss concept of quark model.
B.Sc. III- Semester- VI PHYSICS Paper-XIV DSE-F2: Solid State Physics	
CO1:	Justify SC, BCC, FCC and HCP crystal structure on basis of Co-ordination number, atomic radius, atoms per unit cell and packing fraction
CO2:	Outline X-Ray Diffraction technique including Reciprocal lattice and its properties, , Brillouin zone, Diffraction of X-rays by crystals, Ewald construction, Bragg's law in reciprocal lattice

CO3:	Use Classical Langevin theory to discuss diamagnetic and paramagnetic materials
CO4:	Explain B-H curve, Hysteresis and energy loss. State density of states, Bloch theorem
CO5:	Differentiate between metals, semiconductors and insulators.State hall effect Hall voltage and Hall Coefficient
B.Sc. III- Semester- VI PHYSICS Paper-XV DSE-F3: Atomic and Molecular Physics and Astrophysics	
CO1:	Explain normal and anomalous Zeeman Effect.
CO2:	Explain anomalous Zeeman effect by vector atom model point of view.
CO3:	Compose rotational, vibrational, electronic spectra for molecules
CO4:	Differentiate between Raman and infrared spectra
CO5:	Inspect for and against of theories.
CO6:	Distinguish between sequences of stars. Explain sunspot cycle
B.Sc. III- Semester- VI PHYSICS Paper- XVI DSE- F4: Energy Studies and Materials Science	
CO1:	Compare and contrast the types of energy storage systems.
CO2:	Explain forms of energies and their applications. Analyze solar radiations and its measurements
CO3:	Appreciate that there are relationships and connections between physics and materials to other science disciplines and understand such relationships and connections in physics.
CO4:	Explain wind and bio energy.
CO5:	Describe the superconductivity and list type –I and type –II superconductors
CO6:	Discuss the nanoscience and nanotechnology and their application in day to day life.
B.Sc. Part III Physics Laboratory Experiments	
Group I	Use resonance pendulum to determine damping coefficient of air Examine Surface tension of Soap solution and Mercury. Determine Y by Koenig's method and Cornu's method. Calculate Y and η of given material of Flat spiral Spring.

	Arrange Given set of numbers in Ascending/ Descending order and Find largest and smallest number from given set of numbers using C programming. Use SCILAB to determine eigen values and eigen vectors and to determine Inverse of matrix.
Group II	Trace cardinal points by Turn table and Newton's method. Illustrate Brewster's law to find refractive index of a glass. Examine Diffraction at single slit and at cylindrical obstacle. Determine wavelength of monochromatic source using LLloyd's single mirror. Study refractive indices for extra ordinary and ordinary rays for given prism. Investigate diameter of Lycopodium powder. Plot Caustic curve for a given thick plano convex lens to determine ratio of transverse aberration of extreme rays to radius of least confusion. Study absorption spectrum of given liquid Solution.
Group III	Assess self-inductance by Owen's bridge and mutual inductance by Ballastic galvanometer. Measure B_H, B_V , and θ by magnetometer method. Determine resistance of Ballastic Galvanometer by half deflection method. Determine e/m by Thomson's method. Callibrate wire by Griffiths method. Calculate absolute capacity of condenser. Plot I-V characteristics of Solar Cell. Use p-n junction Diode to calculate Band gap energy of semiconductor. Use LED to determine Planck's constant.
Group IV	Verify truth tables of gates and De- Morgan's theorems with IC- 74 series. Design single stage CE using voltage divider bias, astable multivibrator and momostable multivibrator using IC -555 Timer. To build and Test Colpitts oscillator and phase shift oscillator using BJT. Measure unknown frequency and Determine AC and DC sensitivity of CRO Study OP-AMP as an inverting amplifier and as Schmitt trigger
Group VA	Observe and calculate divergence of LASER beam. Use schusters method for optical leveling of spectrometer. Obtain biprism fringes without lateral shift. Measure Wavelength of LASER using plane diffraction grating and distance between

	two coherent sources using biprism experiment. Plot polar graph using photo cell. Use Tunnel diode to study quantum tunneling effect. Test electronic components. Edit Save and Execute given C programmes
Group VB	Measure Radius of capillary bore using mercury thread, Phase shift of RC network using CRO and resistance of Galvanometer using Kelvin's method. Estimate errors. Determine Lattice constants using XRD powder pattern. Use of half and full adder. Simplify digital circuit using Boolean laws. Wiring of electric bulb, switch and plug. Trace given electronic circuit. Assemble electronic circuit using soldering method.
Group VI	**Assessment of Annual work of a student.** Complete and certify laboratory journal Prepare study tour report. Prepare 2 seminar reports.

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