**Department of Physics**

**Semester-I**

**DSC-1 : Mechanics and Properties of Matter**

**Course Objectives**

1. Understand Newton’s laws and apply them in calculations of the motion of simple systems.
2. Use the free body diagrams to analyze the forces on the object.
3. Understand the concept of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
4. Demonstrate quantitative problem-solving skills in all the topics covered.

**Course Outcomes**

1. Understand Newton’s laws of motion.
2. Recognize different forces existing in nature and their physical significance.
3. Acquire deep knowledge of physical quantities such as elasticity, viscosity and surface tension.
4. Develop the capacity to investigate and analyze daily problems related to mechanical movement.

**DSC-2 : Practicals Based on DSC-1**

**(Mechanics and Properties of Matter)**

**Course Objectives**

1. To familiarize students with fundamental experimental techniques related to principles of elasticity, surface tension, viscosity, and thermal conductivity.
2. To enable students to gain practical insights into the concepts of elasticity, surface tension, viscosity, and heat transfer.
3. To prepare students for advanced laboratory work and research in the related areas of study.

**Course Outcomes**

1. Understand gravitational acceleration through pendulum analysis and learn material stiffness and viscosity determination techniques using various setups.
2. Explore rotational dynamics through flywheel experiments for moment of inertia and Torsional property analysis.
3. Develop instrument precision skills via least count analysis, crucial for physics and related field pursuits.

**SEC-1 : Medical Physics**

**Course Objectives**

1. To learn the construction of X-ray generator.
2. Explain different types of radiation, their sources/properties.
3. The basic principles and working of CT scan, MRI and Ultrasound Imaging.
4. Able to provide adequate knowledge about medical testing equipment.
5. Able to transfer knowledge and skills to students as well as younger professionals.

**Course Outcomes**

1. Understand the principles, applications and usage of various medical equipment including thermometers, glucometer, ECG machines and X-ray machines for diagnostic purposes in healthcare settings.
2. Comprehending the principles and components of Computed Tomography (CT) systems, including image reconstruction, acquisition techniques and factors influencing image quality.
3. Develop a comprehensive understanding and proficiency in various image acquisition techniques, advanced imaging methods, safety protocols and their applications in planning radiotherapy treatments.

**SEC-2 : Practicals Based on SEC-1 (Medical Physics)**

**Course Objectives**

1. Students develop the skills reading the medical instruments.
2. Minimization of errors and get exposure to know the idea of measurements.
3. To do handling and repairing electrical instruments.
4. To develop the skills to touch the social awareness.

**Course Outcomes**

1. Acquire practical skills in healthcare monitoring including using glucometer for blood sugar levels, stethoscope for pulse rates and measuring blood pressure, body temperature, weight and oxygen levels.
2. Develop proficiency in analyzing diagnostic imaging results from X-rays, CT scans and MRIs to draw conclusions about potential health conditions.
3. Enhance understanding of healthcare assessment techniques and diagnostic interpretation facilitating comprehensive healthcare evaluation.

**GE/OE-1 : Everyday Physics**

**Course Objectives**

1. This course serves as a phenomenological introduction to Physics. It aims to introduce students to Physical concepts that are relevant to everyday life.
2. Perform basic calculation/estimations to solve simple physics related problems.
3. Make correct judgment/decisions on physics related issues in their daily life based on basic Physics principles.

**Course Outcomes**

1. The course imparts essential physics principles to real word context covering transportation fundamentals, sports analysis and sustainable weather solutions
2. Students will understand concepts such as linear and circular motion, fictional and energy/ momentum, applying them to transportation and sports.
3. Additionally they will explore sustainable weather management and green energy technologies, gaining practical knowledge about home electricity systems.

**Semester-II**

**DSC-3 : Optics**

**Course Objectives**

1. Understand light behavior in optical systems.
2. Learn light wave interference conditions..
3. Study light wave diffraction phenomena..
4. Develop problem solving skills for analyzing patterns.

**Course Outcomes**

1. Acquire the basic concepts of optics and its applications.
2. Explain how image formation takes place in lenses.
3. Understand the operations of many modern optical devices.
4. Understand the optical phenomenon such as interference and diffraction.

**DSC-4 : Practicals Based on DSC-3 (Optics)**

**Course Objectives**

1. Gain hands on experience in measuring focal lengths of lenses.
2. Investigate interference, diffraction and polarization phenomena through experiments.
3. Develop skills in assembling and calibrating optical instruments.
4. Explore practical applications of optical instruments in various fields.

**Course Outcomes**

1. Understanding of interference and diffraction phenomena through hands on experimentation.
2. Appreciation of practical applications of optical instrument across various scientific disciplines.
3. Proficiency in conducting precise measurements and observations using optical instruments.
4. Analyze experimental results critically and compare them with theoretical expectations.

**VSC-1 : Electrical Measurements**

**Course Objectives**

1. Understanding fundamental concepts of electrical measurements
2. Lear principals of operation, construction and calibration of instruments.
3. Gain proficiency in using measurements instruments to perform basic electrical measurements accurately.
4. Study the characteristics and operation of electrical devices commonly used in measurement applications.

**Course Outcomes**

1. Understand and apply fundamental electrical measurement concepts
2. Gain the skill in selecting appropriate measurement methods and minimizing errors.
3. Understanding of electrical device characteristics and their role in measurement circuits
4. Calibrate instruments and verify their accuracy against standards.

**VSC-2 : Practical based on VSC-1 (Electrical Measurements)**

**Course Objectives**

1. Develop practical skills in electrical measurements including current, resistance and voltage assessment in conducting wires.
2. Enhance understanding of electronic components by collecting resistors. calculating their values and testing circuit continuity using a digital multimeter.
3. Gain proficiency in battery assessment techniques, including measuring voltage of various cells and determining internal resistance using a meter bridge.

**Course Outcomes**

1. Student develop the skill reading the electrical instruments.
2. Minimization of errors and get exposure to know the idea of measurements.
3. To do handling and repair the electrical instruments.

**GE/OE-2 : Physics in Sports**

**Course Objectives**

1. Analyze classical mechanics in sports
2. Explore forces and torque in sports dynamics.
3. Understand the Physics behind the sports gear performance.
4. Explore how environmental conditions affect performance.

**Course Outcomes**

1. Explain how Newton's laws relate to athletic performance.
2. Evaluate sports equipment design and performance.
3. Assess the effects of environmental conditions of athletic performance.
4. Apply strategies for optimizing performance in various conditions.

**Semester-III**

**DSC-5: Modern Physics**

**Course Objectives**

* Explain the fundamental principles of the photoelectric effect, X-rays, and lasers.
* Describe key experimental techniques and their significance.
* Derive and analyse mathematical relationships in modern physics.
* Explore applications of photoelectric devices, X-rays, and lasers.
* Solve numerical and conceptual problems in modern physics.

**Course Outcomes**

* Able to explain the factors influencing photoelectric effect, explain the experimental setup and apply it for applications
* Understand the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry, medicine and Défense
* Use this knowledge for applications of lasers in specific fields of their interest
* Solve numerical problems on the photoelectric effect, X-rays, and lasers.

**DSC-6: Electricity and Magnetism**

**Course Objectives**

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| * Explain Coulomb’s law, Gauss’s law, Biot-Savart law, and Ampere’s law. * Determine electric and magnetic fields for various charge and current distributions. * Understand dielectric properties and key parameters like polarization and displacement. * Solve numerical problems in electrostatics, dielectrics, and magnetostatics.   **Course Outcomes** |
| * Develop an understanding on the concepts of electricity and magnetism. * To understand the knowledge of various mathematical operations required for electrostatics and magnetostatics. * Explain the fundamental concepts and operations of vector analysis. * To increase the ability to perform calculations of various mathematical expressions and laws. * To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of electricity and magnetism   **DSC-7: Practical’s Based on DSC-5**  **Course Objectives** |

* Understand the fundamental principles behind the photoelectric effect and its experimental verification using a photocell.
* Investigate the relationship between photoelectric current and retarding potential and study the characteristics of different types of photoelectric cells.
* Analyse the behaviour of laser beams, including their divergence, diffraction, and interactions with materials.
* Apply optical techniques to measure physical constants like Planck’s constant and the wavelength of light.
* Develop experimental skills in using lasers for precision measurements and analysis of optical phenomena.

**Course Outcomes**

* Verify the inverse square law and measure Planck’s constant using the photoelectric effect.
* Compare luminous intensities of different light sources using photocells.
* Understand and apply the principles of laser optics for diffraction, beam divergence, and precision measurements.
* Analyse experimental data from photocell and laser-based experiments to draw meaningful conclusions about physical constants

**DSC-8: Practical’s Based on DSC-6**

**Course Objectives**

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| * Understand the principles and experimental methods for measuring fundamental electrical and electronic properties. * Determine the energy band gap of a semiconductor using a thermistor. * Explore bridge methods for precise measurement of resistance, capacitance, and inductance. * Analyze the growth and decay of current in RC circuits and evaluate the charge-to-mass ratio (e/m) using Thomson’s method | |
| **Course Outcomes**   * Measure the energy band gap of a semiconductor and analyze temperature dependence. * Perform accurate resistance and capacitance measurements using bridge methods. * Determine high resistance and absolute capacity of a condenser using B.G. techniques. * Investigate transient behavior in RC circuits and determine e/m using Thomson’s method.   **Minor-1: Soil Physics**  **Course Objectives** | |
| * Understanding Soil Composition: Gain knowledge of the composition of soil, including minerals, organic matter, air, and water, and their influence on soil properties. * Soil Structure and Texture: Learn how soil particles are organized to form aggregates and how particle size distribution affects soil texture and structure. * Soil Water Relations: Understand the movement, retention, and availability of water in soils, soil water potential. |
| **Course Outcomes**   * Explain the fundamental concepts, importance, and interdisciplinary interactions of soil physics. * Describe soil formation, profile development, texture, and methods for particle size analysis. * Analyze soil physical properties, including density, porosity, structure, and water content. * Interpret the energy state of soil water, soil-moisture potential, and measurement techniques. |

**Minor-2: Digital Electronics**

**Course Objectives**

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| * Understand the basics of digital electronics and its applications in scientific fields. * Develop proficiency in designing and interpreting simple digital circuits. * Relate digital systems to real-world scientific experiments. * Gain foundational knowledge to explore advanced digital systems in the future. |
| **Course Outcomes**  *:*   * Describe and explain the fundamentals of digital electronics. * Perform number system conversions and basic logic operations. * Design and simulate simple combinational and sequential logic circuits. * Recognize the importance of digital systems in scientific research and experiments. |

**GE/OE: Data Analysis Techniques Using Excel**

**Course Objectives**

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| * To introduce students to the fundamental concepts of data analysis using Microsoft Excel. * To equip students with essential skills for organizing, analyzing, and visualizing data effectively. * To provide practical knowledge relevant to real-world applications in arts, commerce, and science. * To develop decision-making abilities through data interpretation and presentation. |
| **Course Outcomes**   * Understand and apply basic Excel functionalities for data management. * Perform data cleaning, sorting, filtering, and visualization techniques. * Use statistical functions for data interpretation and decision-making. * Create professional reports and dashboards. * Utilize Excel for business and social science applications. |
| **VSC-2: Electrical Vehicle Technology**   |  | | --- | | **Course Objectives**   * To provide fundamental knowledge of electric vehicle systems, components, and principles of operation. * To develop an understanding of energy storage, battery technologies, and charging infrastructure. * To equip students with hands-on experience in basic diagnostics, assembly, and testing of EV components. | | **Course Outcomes**   * Demonstrate a clear understanding of electric vehicle technology and its role in sustainable mobility. * Apply knowledge of battery systems, energy management, and charging techniques in practical scenarios. * Perform basic diagnostics, assembly, and maintenance of electric vehicles. |   **VSC-4: Practical’s based on VSC-2**   |  | | --- | | **Course Objectives**   * Develop hands-on skills in assembling, testing, and troubleshooting electric vehicle (EV) components. * Understand the working principles of an electric drive system, including motor and controller integration. * Foster problem-solving abilities by diagnosing issues and maintaining basic EV systems effectively. | | **Course Outcomes**   * Demonstrate proficiency in assembling and testing a basic electric drive system, ensuring proper functionality. * Analyze and troubleshoot issues in EV components, such as motor performance or battery connections. * Apply safety practices while handling EV components and performing maintenance tasks, ensuring reliability and durability. | |

**SEMESTER- IV**

**DSC-9: Heat and Thermodynamics**

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| **Course Objectives**   * Learn about the heat and transfer of heat, flow of heat which is helpful to know the concept of thermal conductivity. * To gain the knowledge of kinetic theory of heat, state change, Behaviour of gases at different thermodynamic conditions. * Gain knowledge about the laws of thermodynamics, and thermodynamic process * Acquire the knowledge of heat engine, and its efficiency. |
| **Course Outcomes**   * Understand the concepts of heat and thermodynamics. * Describe and apply the physical concepts of heat, and laws of thermodynamics. * Develop ability among the students to identify, remember and grasp the meanings, definitions and laws of heat and thermodynamics. * Perform calculations of heat conduction in various geometries. |
| **DSC-10: Electrodynamics**   |  | | --- | | **Course Objectives**   * Understand electrostatics and apply Gauss’s law to find electric fields. * Learn electromagnetic induction and derive Maxwell’s equations. * Study the nature and propagation of electromagnetic waves. * Apply Poisson’s and Laplace’s equations in electrostatics. * Understand Poynting’s theorem and energy flow in waves. | | **Course Outcomes**   * Apply Gauss’s law to calculate electric fields. * Explain and derive Maxwell’s equations. * Analyze electromagnetic waves in different media. * Solve problems on induction and displacement current. * Use Poynting’s theorem for energy flow analysis. | |

**DSC-11: Practical’s based on DSC-09**

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| **Course Objectives**   * To develop practical skills in basic and conceptual Physics. * To develop students to learn measuring skills in practical. * To familiarize students with fundamental experimental techniques related to heat, conductor of heat and thermal conductivity. * To prepare students for advanced laboratory work and increase the curiosity. |
| **Course Outcomes**   * Understand the theoretical principles of basic practical Physics * Develop awareness of minimizing errors. * Handle carefully various instruments. * Correlate theoretical concepts with the help of experiments. * Gain knowledge about heat, conduction of heat, thermal conductivity of different materials and other phenomena of heat |
| **DSC-12: Practical’s based on DSC-10**   |  | | --- | | **Course Objectives**   * Understand the magnetic field along the axis of a circular coil. * Determine Earth's horizontal and vertical magnetic components using an inductor. * Analyze self and mutual inductance of coils using experimental methods. * Verify electrical network theorems and study rectifier circuits. | | **Course Outcomes**   * Measure and analyze the magnetic properties of materials using a magnetometer. * Determine inductance and charge sensitivity using bridge and galvanometer techniques. * Verify the capacities of condenser using De’Sauty’s method. * Determine the AC mains frequency using a sonometer experiment. | |
| **Minor - 3: Nuclear Chemistry** |
| **Course Objectives**   * Understand the fundamental concepts of nuclear chemistry, including radioactivity, nuclear reactions, and the principles of radioactive decay, with an emphasis on their theoretical and practical applications. * Analyze and calculate energy changes in nuclear fission and fusion processes, and gain insights into the design, working, and safety aspects of nuclear reactors and radiation chemistry. * Explore the applications of radioactive isotopes and tracers in diverse fields such as medicine, agriculture, analytical chemistry, and age determination techniques. |
| **Course Outcomes**   * Understand the principles of radioactivity and radioactive decay, including half-life and radioactive equilibrium, and their applications in various fields. * Analyze nuclear reactions, including fission and fusion, and evaluate the processes and energy changes involved in nuclear reactors and radiation chemistry. * Apply the use of radioactive isotopes and tracers in medicine, agriculture, analytical chemistry, and age determination techniques. |

**Minor-4: Thermal Physics**

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| **Course Objectives**   * Understand the principles of thermometry and various temperature measurement techniques. * Develop a comprehensive understanding of heat transfer methods, focusing on thermal conductivity and its measurement techniques. * Learn the basic concepts of thermodynamics, including laws, processes, and the application of thermodynamic equations. * Gain hands-on experience in analyzing and solving practical problems related to heat transfer and thermodynamic processes. |
| **Course Outcomes**   * Explain and apply the concepts of temperature, thermometers, and various temperature scales. * Develop proficiency in calculating and interpreting thermal conductivity using different methods. * Apply the laws of thermodynamics to various thermodynamic processes and calculate work done in specific processes. * Students will be capable of using and understanding temperature measurement techniques and solving problems related to heat transfer and thermodynamics.   **GE/OE-2: Renewable Energy**  **Course Objectives** |
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| * Know the need of renewable energy resources, historical and latest developments * Discuss wind energy conversion systems and explain sources of geothermal energy * Describe different biogas plants and working of different gasifiers * Explain the working principle of different fuel cells and ocean thermal energy conversion systems * Compare Solar, Wind and bio energy systems, their prospects, advantages and limitations |
| **Course Outcomes**   * Understand different energy sources, their availability, and the advantages and limitations of renewable energy sources. * Explain the working principles of wind and geothermal energy systems, along with their benefits and limitations. * Learn about biomass and biogas-based energy production, their conversion processes, and applications. |
| **SEC-2: Generative AI**   |  | | --- | | **Course Objectives**   * Introduce students to foundational concepts, tools, and applications of Generative AI. * Equip students to creatively apply Generative AI for text, image, and audio content generation. * Provide practical exposure to using Generative AI tools on mobile and desktop platforms. * Foster an understanding of the ethical implications and societal impact of Generative AI. | | **Course Outcomes**   * Understand the foundational principles of Generative AI, including its capabilities and limitations. * Apply Generative AI tools to create innovative and practical content across domains. * Evaluate and address ethical considerations, such as copyright, misinformation, and privacy. * Explore career opportunities and emerging trends in Generative AI.   **SEC-4: Practical’s based on SEC-2** | | **Course Objectives** | | |  | | --- | | * Develop hands-on skills in using Generative AI tools for creating text, images, audio, and videos on Android mobile platforms. * Understand the workflow of Generative AI-based content generation tools and their practical applications in real-world scenarios. * Apply Generative AI tools creatively to design solutions for different business-related challenges. | | **Course Outcomes**   * Demonstrate proficiency in using Generative AI tools on mobile platforms to generate text, images, audio, and videos effectively. * Apply Generative AI techniques to solve practical problems and create innovative content for arts, commerce, and business applications. * Showcase creativity and technical skills in utilizing Generative AI tools responsibly and ethically in real-world scenarios. | | |