Name of the Programme: B.Sc. Physics (FYUGP)

PROGRAMME OUTCOMES

By the end of the B.Sc. programme students will be able to:

PO1. Knowledge and Comprehension: Demonstrate a thorough understanding of fundamental principles and concepts of physics.

PO2. Analytical Skills: Analyze complex physical systems, identify relevant variables, and apply appropriate mathematical methods to solve problems.

PO3. Experimental Skills: Skilled in designing and conducting experiments, using laboratory equipment, and analyzing experimental data to draw valid conclusions.

PO4.Critical Thinking: Critically evaluate scientific literature, identify assumptions, assess the validity of arguments, and develop well-supported conclusions.

PO5. Problem-Solving Skills: Apply physical principles to formulate and solve both theoretical and practical problems.

PO6. Computational Proficiency: Use computational tools and software to model physical systems and analyze data.

PO7. Research and Inquiry Skills: Participate in research and inquiry-based activities, such as creating and executing experiments, collecting and evaluating data, and communicating their findings in a clear and effective manner.

PO8. Communication and Presentation Skills: Express their ideas and discoveries effectively through both written and oral presentations, utilizing suitable scientific language and tools.

PO9. Ethics and Values: Ability to apply ethical reasoning in decision-making, including consideration of social, cultural, and environmental impacts.

PO 10. Interdisciplinary and Multidisciplinary Learning: Combine their understanding and skills with other disciplines and participating in multidisciplinary research and innovation.

PO11. Lifelong learners: Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling.

PO12. Employability: This programme will also help students to enhance their employability for jobs in different sectors.

PROGRAMME SPECIFIC OUTCOMES (PSO)

By the end of the BSc (Physics) programme students will be able to:

PSO1.Advanced Problem Solving: Apply advanced mathematical and computational techniques to solve complex physics problems, including those involving non-linear systems, multi-body interactions, and quantum phenomena. They will be proficient in using differential equations, linear algebra, and numerical methods to develop solutions.

PSO2. Specialized Knowledge in Key Areas: Acquire in-depth knowledge in specialized areas of physics such as condensed matter physics, nuclear physics, astrophysics, or particle physics. They will understand the current research trends and technological applications related to these fields.

PSO3. Practical Laboratory Experience: Gain hands-on experience with modern physics instrumentation and experimental techniques. They will be capable of designing, executing, and interpreting experiments independently, as well as troubleshooting and maintaining sophisticated laboratory equipment. This practical expertise will prepare them for careers in research, industry, or further academic study.

COURSE OUTCOME

Semester 1

Course Title: Mechanics and Properties of Matter

Course Code: C 1

On completing the course, the student will be able to:

CO1 Understand and apply the principles of classical mechanics, including frames of reference, inertial frames, Galilean transformations, and the principle of conservation of linear momentum.

CO2 Demonstrate proficiency in analyzing mechanical systems using the work-energy theorem, understanding the concepts of conservative and non-conservative forces, and applying the principle of conservation of mechanical energy.

CO3 Develop a comprehensive understanding of rotational motion, including the conservation of angular momentum, moment of inertia calculations for various bodies, and the kinetic energy of rotation.

CO4 Gain knowledge of the properties of matter, including the relationship between elastic constants and the behavior of fluids in motion, as well as applications such as Poiseuille's equation for fluid flow through capillary tubes.

CO5 Comprehend and analyze oscillatory motion, including simple harmonic motion (SHM), damped oscillations, forced oscillations, resonance phenomena, and the differential equation governing SHM.

Course Title: Mechanics Course

Code: Minor 1

CO1 Analyze physical systems using Galilean transformations and understand the concept of Galilean invariance, applying it to dynamics problems involving linear momentum conservation.

CO2 Demonstrate proficiency in applying the work-energy theorem, distinguishing between conservative and non-conservative forces, and utilizing energy diagrams to analyze systems, including those in stable and unstable equilibrium.

CO3 Possess a comprehensive understanding of angular momentum conservation principles, including rotational dynamics and the calculation of moment of inertia for various geometries, integrating translation and rotation motion analysis.

CO4 Analyze the behavior of elastic materials under torsional stress and comprehend the kinematics of fluid flow, including the application of Poiseuille’s equation for liquid flow through capillary tubes.

Course Title: Evolution of Science

Course Code: GEC - 1

CO1 Understand the role of science in societal progress and its evolution over time.

CO2 Demonstrate knowledge of key figures and their contributions to the advancement of science, including Aristotle, Galileo Galilei, Robert Hooke, Darwin, Kepler, and particularly Sir Isaac Newton

CO3 Understand the significant scientific developments of the nineteenth century, focusing on the advancements in electricity and magnetism, Maxwell's contributions, and the influential work of Thomas A. Addison.

CO4 Understand the principles of relativity and their implications for our understanding of space, time, and the nature of the universe.

CO5 Develop an awareness of the progression of scientific thought into the modern era.

Course Title: Electrical Wiring and Maintenance

Course Code: SEC – 1

CO1 Understand the fundamental concepts of voltage, current, resistance, and power, applying Ohm's law to analyze basic electrical circuits.

CO2 Identify and analyze main electric circuit elements and their combinations, comprehend the rules for analyzing both DC and AC sourced electrical circuits, including single-phase and three-phase systems.

CO3 Develop the skills necessary for interpreting electrical drawings and symbols, including blueprints, schematics, ladder diagrams, and power circuits

CO4 Possess knowledge of the operation and design of DC and AC generators, transformers, single-phase, three-phase, and DC motors

CO5 Understand solid-state devices as well as electrical protections such as relays, fuses, disconnect switches, circuit breakers, and overload devices, ensuring safety and proper functioning of electrical systems.

Semester II

Course Title: Waves and Optics

Course Code:C- 2

CO1 Understand and apply the principles of superposition of harmonic oscillations, including the linearity and superposition principle, the phenomenon of beats, and the superposition of multiple collinear harmonic oscillations

CO2 Analyze and characterize plane and spherical waves, longitudinal and transverse waves, and understand the propagation of wave energy, wave velocities, and the wave equation, both graphically and analytically.

CO3 Understand harmonic waves, including standing (stationary) waves in strings with fixed and free ends, normal modes of vibration, and the transfer and conservation of energy in vibrating systems

CO4 Comprehend the electromagnetic nature of light, the definition and properties of wavefronts, and the principles of Huygens' principle, temporal and spatial coherence, enabling them to analyze phenomena such as interference and diffraction.

CO5 Analyze interference phenomena, including Young's double-slit experiment, Lloyd's mirror, Fresnel's biprism, and interference in thin films and Newton's rings, as well as the use of Michelson interferometer and Fabry-Perot interferometer for the determination of wavelength, refractive index, and visibility of fringes.

Course Title: Waves and Optics

Course Code: Minor2

CO1 Learn the basics of wave motion.

CO2 Know about the behavior of light due to its wave nature.

CO3 Identify and understand different phenomena due to the interaction of light with light and matter.

CO4 Analyze some of the fundamental laws and principles of light which are used in many important optical instruments.

CO5 Analyze interference phenomena, including Young's double-slit experiment, Lloyd's mirror, Fresnel's biprism, and interference in thin films and Newton's rings, as well as the use of Michelson interferometer and Fabry-Perot interferometer for the determination of wavelength, refractive index, and visibility of fringes.

Course Title: Basic Instrumentation Skills

Course Code: S E C 2

CO1 Understand thorough measurement principles including accuracy, precision, sensitivity, and resolution in electronic instruments.

CO2 Develop proficiency in operating various electronic instruments including multimeters, electronic voltmeters, AC millivoltmeters, and cathode ray oscilloscopes (CROs)

CO3 Interpret block diagrams of electronic instruments including electronic voltmeters, AC millivoltmeters, and CROs.

CO4 Troubleshoot electronic circuits using the instruments CROs, digital multimeters, and signal generators.

CO5 Select appropriate instruments based on their specifications for specific measurement tasks.

Semester III

Course Title: Mathematical Physics – I

Course Code: C- 3

CO1 Analyze functions through techniques such as plotting, continuity, and differentiability, including the application of approximation methods like Taylor and Maclaurin series.

CO2 Understand first and second-order differential equations, including integrating factors, homogeneous and inhomogeneous equations with constant coefficients, and the application of the Wronskian and existence and uniqueness theorems for initial value problems.

CO3 Acquire proficiency in calculus of functions of more than one variable, including partial derivatives, exact and inexact differentials, and constrained maximization using Lagrange multipliers.

CO4 Understand vector calculus, vector algebra, dot and cross products, gradient, divergence, and curl of vector fields, as well as the application of vector identities and theorems such as Gauss' Divergence Theorem and Green's and Stokes' Theorems.

CO5 Understand orthogonal curvilinear coordinates, including Cartesian, spherical polar, and cylindrical coordinates, and their application in deriving gradient, divergence, and curl in various coordinate systems, enhancing their ability to solve problems in diverse physical contexts.

Course Title: General Lab I

Course Code: C- 4

CO1 Develop practical skills in experimental mechanics, including the determination of physical properties such as height using a sextant, spring constant, moment of inertia of a flywheel, and coefficient of viscosity of water using various experimental methods.

CO2 Gain proficiency in utilizing digital timing techniques to measure gravitational acceleration and velocity for freely falling bodies, enhancing their understanding of fundamental principles in mechanics and data acquisition.

CO3 Understand material properties through experiments aimed at determining Young's modulus, modulus of rigidity, and elastic constants using optical lever, Maxwell's needle, and Searle's methods, respectively.

CO4 Develop expertise in experimental techniques in wave and optics, including the determination of frequency using Melde's experiment, phase difference using Lissajous figures, and refractive index, dispersive power, and wavelength measurements using various optical instruments such as interferometers, prisms, and diffraction gratings.

CO5 Enhance their analytical and problem-solving abilities through experiments aimed at determining the properties of light and materials

Course Title: General Lab I

Course Code: Minor-3

CO1 Develop practical skills in experimental mechanics, including the determination of physical properties such as height using a sextant, spring constant, moment of inertia of a flywheel, and coefficient of viscosity of water using various experimental methods.

CO2 Gain proficiency in utilizing digital timing techniques to measure gravitational acceleration and velocity for freely falling bodies, enhancing their understanding of fundamental principles in mechanics and data acquisition.

CO3 Understand material properties through experiments aimed at determining Young's modulus, modulus of rigidity, and elastic constants using optical lever, Maxwell's needle, and Searle's methods, respectively.

CO4 Develop expertise in experimental techniques in wave and optics, including the determination of frequency using Melde's experiment, phase difference using Lissajous figures, and refractive index, dispersive power, and wavelength measurements using various optical instruments such as interferometers, prisms, and diffraction gratings.

CO5 Enhance their analytical and problem-solving abilities through experiments aimed at determining the properties of light and materials

Course Title: Renewable Energy and Energy Harvesting

Course Code: SEC-3

CO1 Develop proficiency in the principles and applications of solar energy technologies, including solar ponds, solar water heaters, solar distillation, solar cookers, and photovoltaic systems, enabling them to design and implement solar energy solutions for various applications.

CO2 Understand wind energy fundamentals, wind turbine technology, and grid integration, allowing them to assess wind energy potential and design efficient wind energy systems with appropriate power electronic interfaces.

CO3 Gain insight into ocean energy resources, including wave, tidal, and ocean thermal energy conversion, and understand the design and operation of wave energy devices, tide energy technologies, and ocean thermal energy systems, fostering the development of sustainable ocean energy solutions.

CO4 Understand geothermal and hydro energy resources and technologies, analyze their environmental impact, and evaluate their feasibility as renewable energy sources

CO5 Develop proficiency in the principles and applications of solar energy technologies, including solar ponds, solar water heaters, solar distillation, solar cookers, and photovoltaic systems, enabling them to design and implement solar energy solutions for various applications.

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