Program and Course Outcome
PHYSICS
CBCS

Program Specific Outcome

By the end of the program B. Sc. (Program) in Physics, the student will be able to:

- Students should formulate, analyze and solve complex and diverse problems through analytical and computational techniques and apply them to other disciplines when appropriate.
- Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological challenges.
- Analyses, test, and interpret technical arguments, and form independent judgments. Gather and organize relevant qualitative and quantitative information such as related problems, examples, and counterexamples.
- The graduates will be able to communicate physical ideas via extended, clear, and well-organized written presentations.
- The degree with physics will prepare students for careers in the corporate sector, tech-industry, and government agencies

Course Outcome

Course Type: Core Course
Semester: 1
Course Code: BPHSCCRC101
Course Title: Mechanics
(L-P-Tu): 4-2-0
Credit: 6
Practical/Theory: Combined

Course Objective: This course aims to provide undergraduate students with a comprehensive understanding of classical (Newtonian) mechanics. Students will learn about the principles of motion, forces, and energy, applying Newton's laws to analyze particle and rigid body dynamics. They will comprehend the concepts of work, energy, momentum, and rotational motion, gaining practical problem-solving skills. The course will also cover topics like gravitation, oscillatory motion, and Elastic properties of material. By the end of the course, students will be equipped to analyze real-world physical phenomena, lay a strong foundation for further studies, and appreciate the role of mechanics in diverse fields like engineering, physics, and astronomy.

Learning Outcome: By the end of this course, undergrad students will: a. Demonstrate a solid understanding of classical mechanics principles, including motion, forces, and energy, and apply

Newton's laws to analyze dynamic systems. b. Develop problem-solving skills in various mechanical scenarios, enhancing their critical thinking and analytical abilities. c. Gain practical knowledge of work, energy, momentum, and rotational motion, and apply them to real-world applications. d. Analyze complex physical phenomena, such as elastic properties of material and harmonic motion, using learned principles and mathematical tools. e. Lay a strong foundation for further studies in engineering, physics, and related disciplines, and appreciate the role of mechanics in understanding the natural world.

Course Type: Core Course
Semester: 2
Course Code: BPHSCCRC201
Course Title: Electricity and Magnetism
(L-P-Tu): 4-2-0
Credit: 6
Practical/Theory: Combined

Course Objective: The objective of this course is to provide students with a comprehensive understanding of electricity and magnetism, covering vector integration, electric fields, electric potential, dielectric properties of matter, magnetic fields, magnetic properties of matter, electromagnetic induction, and electrical circuits. Through theoretical concepts, practical experiments, and problem-solving exercises, students will develop a strong foundation in the fundamental principles of electricity and magnetism. The course aims to equip students with the knowledge and skills necessary to analyze, predict, and apply electromagnetic phenomena in various engineering, scientific, and technological contexts of their surroundings.
Learning Outcome: On completion of the course, the student should have the following learning outcomes defined in terms of knowledge, skills and general competence: Knowledge: The student has acquired detailed knowledge of electromagnetism (electric and magnetic force and field, induction) and preliminary knowledge of electromagnetic waves. Skills: The student can solve problems with moderate mathematical complexity related to electric and magnetic force and field, electric charge, electric potential, current, voltage and resistance, capacitors. They will be expert in application of Gauss law, Faradays law, Lenz law. General competence: Enhanced ability to handle force at a distance phenomenon.

Course Type: Core Course
Semester: 3
Course Code: BPHSCCRC301
Course Title: Thermal Physics and Statistical Mechanics
(L-P-Tu): 4-2-0
Credit: 6
Practical/Theory: Combined

Course Objective: This course aims to provide students with a comprehensive understanding of the principles and concepts of thermal physics. Students will learn about thermodynamic laws, temperature, heat, and work. They will analyze the behavior of gases, phase transitions, and thermal properties of

materials. The course will cover topics such as heat conduction in material, heat engines, entropy, and the kinetic theory of gases. Students will apply these principles to solve practical problems in engineering and everyday life. By the end of the course, students will be equipped to analyze and interpret thermal phenomena and appreciate their relevance in various scientific and technological applications.
Learning Outcome: By the end of this course, students will: a. Demonstrate a comprehensive understanding of the fundamental principles of thermal physics, including thermodynamic laws and heat transfer mechanisms. b. Analyze and predict the behavior of gases, liquids, and solids under varying temperature and pressure conditions. c. Comprehend the concepts of heat engines, refrigerators, and their practical applications in engineering and technology. d. Apply statistical mechanics and the kinetic theory of gases to interpret the macroscopic properties of matter at the molecular level. e. Evaluate and solve complex problems related to heat conduction, convection, and radiation in various physical scenarios. f. Develop practical skills in conducting thermal experiments and data analysis, reinforcing theoretical concepts and enhancing problem-solving abilities. g. Recognize the significance of thermal physics in various disciplines and its relevance to real-world applications in energy, environment, and technology.

Course Type: Skill Enhancement Course
Semester: 3
Course Code: BPHSSERT304
Course Title: Renewable Energy and Energy Harvesting
Credit: 2
Practical/Theory: Theory

Course Objective: To create awareness among the students about the different types of non-conventional energy resources and emphasize its importance.
Learning Outcome: Able to understand the renewable energy sources available at present. Able to understand the solar energy operation and its characteristics. To educate the wind energy operation and its types. To educate the tidal and geothermal energy principles and its operation. Able to understand the biomass energy generation and its technologies

Course Type: Core Course
Semester: 4
Course Code: BPHSCCRC401
Course Title: Waves and Optics
(L-P-Tu): 4-2-0
Credit: 6
Practical/Theory: Combined

Course Objective: This course aims to provide students with a comprehensive understanding of wave motion, oscillatory phenomena, as well as the principles of optics. Students will learn about the properties of waves, wave equations, and superposition. They will study harmonic oscillations, resonance, and wave interference. The course will cover topics such as light propagation, reflection, refraction, and diffraction. By the end of the course, students will be able to analyze wave and

oscillatory behavior, comprehend optical principles, and apply their knowledge to real-world applications.
Learning Outcome: By the end of this course, students will: a. Analyze wave properties and wave interference accurately. b. Understand harmonic oscillations, resonance, and wave superposition effectively. c. Apply optics principles to analyze light propagation, reflection, refraction, and diffraction. d. Design and optimize optical systems for specific applications. e. Proficiently use mathematical tools to solve complex wave and oscillation problems. f. Demonstrate practical expertise in conducting precise wave and optics experiments. g. Critically evaluate scientific literature in wave and optics. h. Appreciate the significance of wave and optics in modern science and technology. Overall, this course will provide students with a high level of competency in wave and optics, equipping them with the skills to analyze, predict, and apply wave and optical principles to solve complex problems and contribute effectively in scientific and technological endeavors.

Course Type: Skill Enhancement Course
Semester: 4
Course Code: BPHSSERT404
Course Title: Computational Physics Skills
Credit: 2
Practical/Theory: Theory

Fortran programming and numerical analysis Writing programs in Fortran to solve numerical analysis programme. Solving algebraic, transcendental, and polynomial equations Solutions of linear simultaneous equations. Solution of differential equations. Finding values of integrals. Finding eigenvalues and eigenfunctions. Methods of least squares and curve fitting. Generation of random numbers and their applications in finding values. of integrals Monte Carlo simulation.
Different number systems; representation of integer and real numbers; ASCII codes. Programming of different solutions stated above in the FORTRAN language. The students acquire skills to apply different computational techniques to a different field of physics.

Course Type: Discipline Specific Elective
Semester: 5
Course Code: BPHSDSRT1
Course Title: Classical Dynamics
(L-P-Tu): 5-0-1
Credit: 6
Practical/Theory: Theory

Lagrange's and Hamilton's formalism: Generalised coordinates, Virtual work, Principle of Least Action, Lagrange's equation of motion, Hamilton's Principle, Noether's Theorem. Two-body central force problem, effective potential technique, study of kepler system, Rigid body Kinematics, Euler angles,rigid

rotator and heavy symmetrical top. Hamilton's equation, Routh's Procedure, Canonical transformations, Poisson brackets, Liouville's theorem. Hamilton Jacobi Theory, action- angle variables. Small oscillations, normal coordinates, continuous system, Lagrangian and Hamilton formalism of continuous systems and fields, special theory of relativity, four vectors and metric, Lagrangian formulation of relativistic mechanics, Nonlinear dynamics, periodic motions, chaotic trajectories and Liapunov exponents. In this paper we teach Special theory of Relativity (STR) at an advanced level.
The students learn STR and acquire knowledge of four vectors and tensors more vigorously to use it to understand Advanced Quantum Mechanics, Nuclear Physics, Particle Physics and other papers in the next semesters Students acquire basic knowledge of Mechanics, skills and techniques to solve a mechanical problem, Students learn rocket launching, satellite parking parameters, MOMS parameters and time of flight and other techniques how to divert the path of an asteroid if it is coming in the direction of the earth.

Course Type: Discipline Specific Elective
Semester: 5
Course Code: BPHSDSRT2
Course Title: Astronomy & Astrophysics
(L-P-Tu): 5-0-1
Credit: 6
Practical/Theory: Theory

The knowledge of representation of very large and small distances and their practical units are introduced. The students gain knowledge of the different techniques to measure distance of a star and formulas for measuring distances. It is taught here that the sun is a controlled thermonuclear reactor with a variety of new physics that emerged out of the study of the light and neutron coming out of it. The sun has two faces one that exists for a few days/months and other that exist for millions of years. The use of quantum mechanics, nuclear physics and statistical mechanics are learned by them here. It is shown here that they need Einstein's General theory of Relativity for describing the phenomena of the universe and in the case of neutron stars and Black holes. They also learn how the universe originated in the past (Big Bang theory) and what are the different phases. The experimental tests upon which the cosmological theories are built up. The different cosmological parameters for understanding the observed universe.
The students learn to solve problems to determine the surface temperature of a star in terms of the surface temperature of the sun if the luminosity of the star is determined. They determine the age of the universe. Determines the density of an X-ray Pulsar from the knowledge of its time period of rotation. Many features of the universe which are not understood by STR and Classical Mechanics. Life history of a star, Galaxy, clusters and superclusters.

Course Type: Skill Enhancement Course
Semester: 5
Course Code: BPHSSERT504
Course Title: Basic Instrumentation Skills
Credit: 2
Practical/Theory: Theory

Knowledge gained in areas like (i) Feedback in amplifiers, (ii) Audio power amplifiers, (iii) Oscillators, (iv) Power supplies and Electronic regulators, (v) Some special application of OP AMP, (vi) Digital electronics and (vii) Networks and lines.
The students acquire skills to design different electronic circuits like (i) Feedback amplifiers, (ii) Audio power amplifiers, (iii) Oscillators, (iv) Electronic regulators, (v) Digital circuits and (vii) Filters and transmission lines.
Students should be competent enough to design different electronic circuits which are very useful in the application point of view.

Course Type: Discipline Specific Elective
Semester: 6
Course Code: BPHSDSRT3
Course Title: Nuclear and Particle Physics
(L-P-Tu): 5-0-1
Credit: 6
Practical/Theory: Theory

The students gather advanced knowledge in Nuclear physics. The different nuclear interactions and the corresponding nuclear potentials and its dependence on the couplings are learned. The knowledge helps to choose for an Advance course in Nuclear and particle Physics.

The course gives an understanding of the nucleus at low energy.

The students develop basics to solve some of the problems of nuclear physics and their limitations in nature.

Course Type: Discipline Specific Elective
Semester: 6
Course Code: BPHSDSRT4
Course Title: Physics of Earth

(L-P-Tu): 5-0-1
Credit: 6
Practical/Theory: Theory

Course Objective: Discuss the theoretical basis for modern global seismology and employ methods based on such theory to understand earthquake phenomena and the seismological probing of earth structure. Explain the governing dynamics of mantle and lithosphere, and use such understanding to make reliable estimates of the forces controlling plate motions and their temporal changes.
At the end of this course, student should have a broad, comprehensive overview of the physical processes operating in the solid Earth and its core and a quantitative understanding of the principles of the geophysical techniques by which this information is derived. Student will also have gained practical experience and understanding of geophysical exploration techniques and how observations can be interpreted. These practical sessions will give you experience of carrying out routine lines of enquiry into professional level problems. You will be able to critically evaluate evidence based solutions to these problems. The assessed scientific report and degree exams will give the students practice conveying complex information to a range of audiences for a range of purposes which is a valuable transferable skill.

Course Type: Skill Enhancement Course
Semester: 5
Course Code: BPHSSERT604
Course Title: Electrical circuits and Network Skills
Credit: 2
Practical/Theory: Theory

Course Objective: The objective of this course is to help the student to diagnose the electrical and electronic circuit problem.

Learning Outcome: Upon completion of the course, students will 1. develop an understanding of the fundamental laws and elements of electrical circuits. 2. learn the energy properties of electric elements and the techniques to measure voltage and current. 3. develop the ability to apply circuit analysis to DC and AC circuits.