DEPARTMENT OF PHYSICS

PROGRAMME SPECIFIC OUTCOMES (PSO) OF PHYSICS HONOURS AND GENERAL

PSO1. Physics deals with a wide variety of natural as well as synthetic systems, from microscopic level (atoms, nucleus) to Astronomical level (Sun, galaxy). Basic principles are more-or-less same used by physicists at every level. Each of these theories are experimentally verified in a number of ways and found to be a sufficiently appropriate description of nature. Students get oriented along this line of thinking and earn enough proficiency to use Physical Principles/concepts to explain various phenomena.

PSO2. Physics uses mathematics as a tool to organize and formulate experimental results. Students gather handsome knowledge on mathematics required for formulating and solving problems.

PSO3. Students learn to perform various types of numerical calculations.

PSO4. Students acquire laboratory skills, enabling them to take measurements in a physics laboratory and analyse the measurements to draw valid conclusions.

PSO5. Students will develop good oral and written scientific communication skill.

PSO6. Students learn to think critically and work independently.

COURSE OUTCOMES (CO) OF PHYSICS HONOURS

CORE COURSES (CC)

PHSA-CC-1-1-TH & PHSA-CC-1-1-P (Mathematical Physics 1 – Theory & Practical)

1) To acquire knowledge of calculus which are integral part of any branch of Physics
2) Understand divergence, gradient and curl and their physical interpretation which are very important for theories of electricity and magnetism to be taught later.
3) Understand basics of matrices and determinants i.e. inverses, adjoint, linear vector spaces, basis, basis transformations, how to calculate eigenvalues, eigenvectors. Solve simple problems with physics oriented application.
4) To develop the problem solving capability

PHSA-CC-1-2-TH & PHSA-CC-1-2-P (Mechanics Theory & Practical)

CO1. Students learn accurately how to describe motion of objects, planetary motions, and gravitation etc. and understand the motion of objects in different frame of references.
CO2. Know how to apply the conservation principle and symmetry of a system.
CO3. Understand laws of motion, reference frames, and its applications i.e. projectile motion, simple harmonic oscillator, Rocket motion, elastic and inelastic collisions.
CO4. Understand the idea of conservation of angular momentum, central forces effective potential.
CO5. Understand the application of central force to the stability of circular orbits, Kepler's laws of planetary motion.

CO6. Understand the dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia and related examples involving the centrifugal force and coriolis force.
CO7. Learn that different kinds of matter have various properties. For example, pressure, surface tension is important properties for a fluid, but stress, Modulus are important properties of solid objects.
CO8. Understand the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, and beam supported at its ends and loaded in the middle.
CO9. Know the basics of motion of fluid which includes streamlined and turbulent flows, equation of continuity, critical velocity, and flow of a liquid through a capillary tube.

PHSA-CC-2-3-TH & PHSA-CC-2-3-P (Electricity and Magnetism – Theory & Practical)

CO1. To learn about basic concepts of electrical charges and currents and their properties
CO2. Enhance problem solving capability based on various realistic situation
CO3. Understand the concept of conductors, dielectrics, inductance and capacitance.
CO4. Gather knowledge on the nature of magnetic materials.
CO5. Understand the concept of static and time varying fields.
CO6. Gain knowledge on electromagnetic induction and Faraday's law and its applications
CO7. Learn about EM waves and its propagation
CO8. Learn to use and solve Maxwell's equations

PHSA-CC-2-4-TH & PHSA-CC-2-4-P (Waves and Optics – Theory & Practical)

CO1. Students learn about various types of waves and their propagation.
CO2. To provide a basic understanding of physical and geometrical optics
CO3. To provide a knowledge of various optical phenomena, for example interference, diffraction, polarization etc.

PHSA-CC-3-5-TH & PHSA-CC-3-5-P (Mathematical Physics II – Theory & Practical)

CO1. Understand how to expand a function in a Fourier series.
CO2. Solving differential equation using power law expansion (so called Frobenius method).
CO3. Learn about various special functions i.e. Legendre, Bessel functions, generating functions and their properties.
CO4. Fourier integral and its properties and application to signal analysis and also in quantum mechanics
CO5. Application of probability and various distribution functions in Physics.
CO6. Learn to solve partial differential equation which is very important in all branches of physics.

PHSA-CC-3-6-TH & PHSA-CC-3-6-P (Thermal Physics – Theory & Practical)

CO1. To understand the principle of calorimetry
CO2. Understand the basic principle and laws of Thermodynamics
CO3. Understand the concepts of Entropy, various thermodynamic potentials and their applications in various systems
CO4. Gain knowledge about microscopic behaviour of systems in explaining pressure, transport properties, viscosity, diffusion etc.

PHSA-CC-3-7-TH & PHSA-CC-3-7-P (Modern Physics – Theory & Practical)

CO1. To know about Radiation and its nature, old quantum theory, concept of wave-particle duality and de Broglie hypothesis.
CO2. To learn about Schrodinger equation as first principle, probabilistic interpretation of quantum mechanics, commutation relation and their meaning. These are very crucial as students learn Quantum Mechanics for the first time and these are basic building block of modern physics.
CO3. Students learn about Nuclear structure and various models, Interaction within and with nucleus, Gamma, Beta decay and Nuclear Fission and Fusion

PHSA-CC-4-8-TH & PHSA-CC-4-8-P (Mathematical Physics III – Theory & Practical)

CO1. To study complex analysis, Cauchy Riemann conditions, Analyticity, Cauchy Integral formula, Laurent and Taylor series expansion and definite integrals using contour integration.
CO2. To learn variational calculus. Lagrangian and Hamiltonian formulation, Euler-Lagrange equation, Use of symmetry and conservation laws.
CO3. To understand special theory of relativity, length contraction, time dilation, mass-energy relation etc. This is one of the corner stone of modern physics.

PHSA-CC-4-9-TH & PHSA-CC-4-9-P (Analog Electronics – Theory & Practical)

CO1. To know basic Boolean principle and how various electronic instruments work based on this
CO2. To motivate the students to apply the principles of electronics in their day-to-day life.
CO3. Learn various network theorems, diodes and their application
CO4. Study various theory and working principles of transistors, regulated power supply, amplifiers, concept of feedback, OPAMP, Multivibrators and Oscillators

PHSA-CC-4-10-TH & PHSA-C-4-10-P (Quantum Mechanics – Theory & Practical)

CO1. One of the most important subject in undergraduate course. Students solve various quantum mechanical features by solving various potentials: example, Finite and infinite well, Harmonic oscillator
CO2. Learn Quantum theory of Hydrogen atoms, solution of Schrodinger equation under central force, Orbital angular momentum and spin angular momentum
CO3. To know generalized angular momenta, Electron's magnetic moment, Energy of a magnetic dipole, Stern-Garlach experiment
CO4. To study Fine structure of hydrogen atoms, atoms in presence of electric and magnetic fields-- application of Quantum mechanics for atomic systems
CO5. To learn Many electron atoms, identical particles, Pauli principle.

PHSA-CC-5-11-TH & PHSA-CC-5-11-P (Electromagnetic Theory – Theory & Practical)

CO1. Learn Maxwell's equations, gauge transformations, Pyonting vector, Electromagnetic field energy density, momentum density etc.
CO2. Learn about propagation of electromagnetic wave through medium
CO3. Learn about Polarization

PHSA-CC-5-12-TH & PHSA-CC-5-12-P (Statistical Physics – Theory & Practical)

CO1. To understand statistical properties of matter, connections with thermodynamics
CO2. To use these theory in practical systems (ideal gas, Bose and Fermi systems), Identical particles
CO3. To learn Bose-Einstein statistics, and its application, Fermi-Dirac statistics and its application

PHSA-CC-6-13-TH & PHSA-CC-6-13-P (Digital systems and applications – Theory & Practical)

CO1. To learn integrated circuits(IC), number system and Boolean description, introduction to logic systems, various Gates
CO2. To understand product and sum in logical expression, conversion between truth table and logical expression, Karnaugh map
CO3. To learn how to Implement different circuits: adder, subtractor, idea of multiplexer, demultiplexers, encoder, and decoder
CO4. To know registers and counters, computer organization, data conversion.

PHSA-CC-6-14-TH & PHSA-CC-6-14-P (Solid State Physics – Theory & Practical)

CO1. To learn crystal structure, lattice dynamics
CO2. To understand quantum properties of matter like magnetic property, dielectric property
CO3. To understand elementary band theory
CO4. To understand Superconductivity – one of major breakthrough in modern science

DISCIPLINE SPECIFIC ELECTIVES (DSE)

SEMESTER – V

PHSA-DSE-A1(b)-TH (Laser and Fiber Optics)

CO1. To know theory of laser, its basic properties
CO2. To learn about resonators, transient effect, many laser systems and practical use of laser

PHSA-DSE-B1(a)-TH (Astronomy and Astrophysics)

CO1. Gain knowledge on various tools of astronomy, basic introduction of starts, galaxies, interstellar medium, mass and length scales of astronomy
CO2. To learn observational tools of astronomy
CO3. To understand star and other stellar systems, formation and evolution of stars
CO4. To know about the galaxies and its components
CO5. To learn basics of cosmology, redshift, field equations and accelerating universe

SEMESTER – VI

PHSA-DSE-A2(a)-TH (Nano Materials and applications)

CO1. To learn about nanoscale systems, their band structures, application of Schrodinger equation for such nano structures
CO2. To know how to synthesis nano materials and how to characterize them
CO3. To know various properties of nano materials, e.g. optical and electrical (transport) properties

PHSA-DSE-B2(a)-TH (Communication Electronics)

CO1. To introduce students to basics of electronic communication
CO2. To learn analog modulations and to modulate analog pulse
CO3. To learn how to modulate digital pulse
CO4. Students are introduced to communication and navigation system, which has many modern day applications.

SKILL ENHANCEMENT COURSES

SEMESTER – III

PHSA-SEC-A2-TH (Renewable energy and Energy Harvesting)

Students learn about fossil fuels and its hazards and need for alternative energy sources, how to harvest energy from various non-conventional energy sources

SEMESTER – IV

PHSA-SEC-B2-TH (Electrical Circuits and Network Skills)

Students know about various electrical instruments (generators, transformers, AC motor etc.).

PRACTICAL TOPICS

Practicals of Mechanics, Thermodynamics, Electricity and Magnetism, Waves, Optics, Modern Physics

CO1. Various theories which students learn in theory lesson are verified in practical classes.
CO2. Students learn various practical situation, how to handle tools and instruments, measurement techniques, graph plotting, statistical/error estimations etc.
CO3. Physics is essentially a practical based subject, knowledge of proving/disproving a certain theory is important. Practicals bridge between theoretical knowledge and real life situation.

Practicals based on Computation and Programming (Python language)

CO1. Understand how to write an algorithm, iteration techniques
CO2. Various numerical methods to solve many problems numerically. E.g. finding solution of an equation, integration and differentiation etc.

CO3. Plotting different kinds of graphs, how to label them etc. knowledge/information based on facts available.
CO4. The mathematical skill and theoretical principles learnt during the three-year program, help them motivate and contribute to the society by actively participating in innovative research, teaching. Also, they can induce rational thinking to the society which is, otherwise, very important in today's scenario.
CO5. Students are well prepared for cutting edge research activity for example, Nano Science, Astrophysics, Nuclear and Particle Physics, Condensed Matter Physics etc.

COURSE OUTCOMES (CO) OF PHYSICS GENERAL

GENERIC ELECTIVES (GE)

PHS-G-CC-1-1-TH & PHS-G-CC-1-1-P (Mechanics –Theory & Practical)

CO1. Students learn accurately how to describe motion of objects, planetary motions, and gravitation etc. and understand the motion of objects in different frame of references.
CO2. Know how to apply the conservation principle and symmetry of a system.
CO3. Understand laws of motion, reference frames, and its applications i.e. projectile motion, simple harmonic oscillator, Rocket motion, elastic and inelastic collisions.
CO4. Understand the idea of conservation of angular momentum, central forces effective potential.
CO5. Understand the application of central force to the stability of circular orbits, Kepler's laws of planetary motion.
CO6. Understand the dynamics of rotating objects i.e. rigid bodies, angular velocity, the moment of inertia and related examples involving the centrifugal force and coriolis force.
CO7. Learn that different kinds of matter have various properties. For example, pressure, surface tension is important properties for a fluid, but stress, Modulus are important properties of solid objects.
CO8. Understand the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, and beam supported at its ends and loaded in the middle.
CO9. Know the basics of motion of fluid which includes streamlined and turbulent flows, equation of continuity, critical velocity, and flow of a liquid through a capillary tube.

PHS-G-CC-2-2-TH & PHS-G-CC-2-2-P (Electricity and Magnetism – Theory & Practical)

CO1. To learn about basic concepts of electrical charges and currents and their properties
CO2. Enhance problem solving capability based on various realistic situation
CO3. Understand the concept of conductors, dielectrics, inductance and capacitance.
CO4. Gather knowledge on the nature of magnetic materials.
CO5. Understand the concept of static and time varying fields.
CO6. Gain knowledge on electromagnetic induction and Faraday's law and its applications
CO7. Learn about EM waves and its propagation
CO8. Learn to use and solve Maxwell's equations

PHS-G-CC-3-3-TH & PHS-G-CC-3-3-P (Thermal Physics and Statistical Mechanics – Theory & Practical))

CO1. To understand the principle of calorimetry
CO2. Understand the basic principle and laws of Thermodynamics
CO3. Understand the concepts of Entropy, various thermodynamic potentials and their applications in various systems
CO4. Gain knowledge about microscopic behaviour of systems in explaining pressure, transport properties, viscosity, diffusion etc.
CO5. To understand statistical properties of matter, connections with thermodynamics
CO6. To use these theory in practical systems (ideal gas, Bose and Fermi systems), Identical particles
CO7. To learn Bose-Einstein statistics, and its application, Fermi-Dirac statistics and its application

PHS-G-CC-4-4-TH & PHS-G-CC-4-4-P (Waves and Optics – Theory & Practical)

CO1. Student learns about various types of waves and their propagation.
CO2. To provide a basic understanding of physical and geometrical optics
CO3. To provide a knowledge of various optical phenomena, for example interference, diffraction, polarization etc.

SKILL ENHANCEMENT COURSES (SEC)

SEMESTER – III

PHS-G-SEC-A2-TH (Renewable Energy and Energy Harvesting)

Students learn about fossil fuels and its hazards and need for alternative energy sources, how to harvest energy from various non-conventional energy sources.

SEMESTER – IV

PHS-G-SEC-B2-TH (Electrical Circuits and Network Skills)

Students know about various electrical instruments (generators, transformers, AC motor, etc.)

DISCIPLINE SPECIFIC ELECTIVES (DSE)

SEMESTER – V

PHS-G-DSE-A-TH & PHS-G-DSE-A-P (Analog Electronics)

CO1. To know basic Boolean principle and how various electronic instruments work based on this
CO2. To motivate the students to apply the principles of electronics in their day-to-day life.
CO3. Learn various network theorems, diodes and their application
CO4. Study various theory and working principles of transistors, regulated power supply, amplifiers, concept of feedback, OPAMP, Multivibrators and Oscillators

SEMESTER – VI

PHS-G-DSE-B-TH & PHS-G-DSE-B-P (Digital Electronics)

CO1. To learn integrated circuits(IC), number system and Boolean description, introduction to logic systems, various Gates
CO2. To understand product and sum in logical expression, conversion between truth table and logical expression, Karnaugh map
CO3. To learn how to Implement different circuits: adder, subtractor, idea of multiplexer, demultiplexers, encoder, and decoder
CO4. To know registers and counters, computer organization, data conversion.