COURSE, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES OF PHYSICS

The Department has formulated the following programme outcomes for the physics graduate and physics postgraduate students:

Programme Outcomes

PO1 **Physics Knowledge:** To provide students with the basic foundation in physics, the scientific method (theory and experiment) and to motivate scientific enthusiasm and curiosity and the joy of learning.

PO2 **Solving Skills:** To provide students with the tools needed to analyze problems, apply mathematical formalism and experimentation and synthesize ideas.

PO3 **Technical Skills:** To provide the students with technical skills necessary for successful career in physics and related fields.

PO4 **Communication Skills:** To provide the students with dissemination of knowledge of physics from basic concepts to specific details through a variety of oral, written and computational modalities.

Programme Specific Outcomes

PSO1 Students are expected to acquire core knowledge with facts and figures in physics.

PSO2 Students should acquire the skills in handling scientific instruments, planning and performing in laboratory experiments.

PSO3 Students will realize and develop an understanding of the impact of physics and science on society.

PSO4 Students will be able to apply conceptual understanding of the physics to general real-world situations.

PSO5 Students will be able to discover the concepts of physics in other disciplines such as mathematics, computer science, engineering and chemistry.

PSO6 Students will be able to analyze physical problems and develop correct solutions using natural laws.

CERTIFICATE COURSE IN BASIC PHYSICS

Semester-I

Paper: Mechanics &Theory of Waves and Oscillations

CO1 Understanding of Vector Algebra and Vector Calculus, the physical interpretation of gradient, divergence and curl.

CO2 Study of gravitational field and potential and understanding of Kepler's laws of Planetary motion, different frames of references and conservation laws.

CO3 Understanding of the dynamics of rigid body and concept of moment of inertia,

moment of inertia of different bodies and the properties of matter, response of the classical systems to external forces and their elastic deformation and its applications.

CO4 Comprehension of the dynamics of Fluid and concept of viscosity and surface tension along with its applications and comprehensive study of the theory of waves and oscillations.

Minor Elective
Semester-I

Paper : Basic Physics-I

CO1 Understanding of the nature of forces and Newton's laws of motion.

CO2 Understanding of the rotational motion and angular variables.

CO3 Exploration of the concepts of work and energy.

CERTIFICATE COURSE IN BASIC PHYSICS
Semester-II

Paper : Electricity and Magnetism

CO1 Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for different types of charge distributions and study of Electric and Magnetic Fields in matter.

CO2 Understanding of the concept of polarizability, Magnetization and Electric Displacement, Vector Study of Steady and Varying electric currents.

CO3 Understanding of different aspects of alternating currents and its applications, the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.

CO4 Comprehending the different aspects of Electromagnetic induction and its applications.

Minor Elective
Semester-II

Paper : Fundamental Mechanics

CO1 Understanding of the Vectors Algebra and Ordinary Differential Equations.

CO2 Understanding of the Translatory and Rotatory Motion and Conservation Laws.

CO3 Exploration of the Gravitation and Elasticity.

Second Year

Paper I Heat, Thermodynamics and Statistical Physics

CO1 Understanding of First and Second Law of Thermodynamics and Entropy.

CO2 Understanding of the Thermodynamic potentials, Maxwell’s equation from thermodynamic potentials.

CO3 Exploration of the Modes of heat transfer via Conduction, Convection and Radiation.

CO4 Understanding of the kinetic theory of gases and basic concepts in statistical physics.

Paper II Optics

CO1 Understanding of the Fermat's Principle and Theory of Image Formation by lens.

CO2 Exploration of the optical Aberrations and Dispersion of lenses.

CO3 Understanding of the superposition principle and interference phenomena of light.

CO4 Understanding of the diffraction and polarization of light.

Third Year

Paper I Modern Physics

CO1 Understanding of the Origin of Quantum Mechanics and its Operator Formulation.

CO2 Exploration of the Schrodinger Equation and its Application.

CO3 Understanding of the theory of atomic models, optical spectra, molecular spectra and theory of Lasers.

CO4 Exploration of the basics of subatomic and particle physics.

Paper II Electronics

CO1 Understanding of the network theorems, power supplies and its applications.

CO2 Understanding of the solid state devices like diodes, transistors and field effect transistors.

CO3 Exploration of the various amplifiers and their frequency responses.

CO4 Understanding of the basics of digital electronics.

M. Sc. Physics Course Outcomes

Semester-I

Paper I Mathematical Physics

At the end of this course, students will be able to:

CO1 Solve differential equations-Legendre, Bessel, Hermite and Leguerre that are common in physical sciences.

CO2 Use the knowledge of tensors to understand phenomenon like stess and strain.

CO3 Master the basic elements of Complex mathematical analysis.

CO4 Apply Fourier an integral transforms to solve mathematical problems of interest in Physics.

Paper II Classical Mechanics

At the end of this course, students will be able to:

CO1 Understand the mechanics of the Many particles system, various conservation laws and their applications.

CO2 Understand the equation of motion of complicated mechanical systems using the Lagrangian and Hamiltonian formulation of classical mechanics.

CO3 Explain the dynamics of rigid body.

CO4 Gain knowledge on the application of Hamilton's equations in solving the

equation of motion of a particle in central force problems.

Paper III Quantum Mechanics

At the end of this course, students will be able to:

CO1 Know the operator formulations of quantum mechanics and quantum dynamics is developed.

CO2 Understand non-relativistic quantum mechanics and Schrödinger equations theory of orbital and spin angular momentum, its eigen value and eigen functions and Pauli's theory of spin.

CO3 Understand WKB approximations with time independent perturbation theory, anomalous Zeeman effect, variation methods and its applications.

CO4 Explain time dependent perturbation theory and its applications.

Paper IV Statistical Mechanics

At the end of this course, students will be able to:

CO1 Explain the basic concepts of foundation of statistical mechanics and define the connection between statistics and thermodynamics systems.

CO2 Understand the basic statistical properties and statistical distributions.

CO3 Impart the knowledge about theory of phase transitions and various statistical Models.

CO4 Understand Bose-Einstein and Fermi- Dirac distributions, Degeneracy, Gas degeneration, Degenerate Bose gas, Bose Einstein condensation, Highly degenerate B-E and F-D gases.

CO3 Explain gravitational waves and gravitational radiation.

CO4 Understand basic concepts, elementary ideas of big-bang theory and cosmology.

Paper V Atomic and Molecular Physics

At the end of this course, students will be able to:

CO1 Explain fine structure of Hydrogen spectrum, LS and JJ coupling and Pauli exclusion principle.

CO2 Explain atomic spectra of one or two valance electron atoms and the behaviour of atoms in external applied electric and magnetic field.

CO3 Understand rotational and vibrational spectra of diatomic molecules.

CO4 Explain electronic spectra and classical and quantum theory of Raman spectra.

Semester-II

Paper I General Relativity and Cosmology

At the end of this course, students will be able to:

CO1 Give coherent explanation of the principles associated with special relativity, general relativity and cosmology.

CO2 Explain Einstein's field equations and gravitational dynamics.

CO3 Explain gravitational waves and gravitational radiation.

CO4 Understand basic concepts, elementary ideas of big-bang theory and cosmology.

Paper II Advance Quantum Mechanics

At the end of this course, students will be able to:

CO1 Understand kinematics of scattering process, method of partial wave analysis, Born approximation and its application in non-relativistic theory of quantum scattering.

CO2 Explain atomic spectra of one or two valance electron atoms and the behaviour of atoms in external applied electric and magnetic field.

CO3 Explain Dirac equation in electromagnetic field, gauge invariance of Dirac equations in electromagnetic fields and discrete symmetries of Dirac equation.

CO4 Understand the quantum behavior of identical particles and second quantization of Schrodinger's field and related concepts.

Paper III Nuclear Physics

At the end of this course, students will be able to:

CO1 Understand the nuclear properties, binding energy, semi-empirical mass formula and various nuclear models for the nuclear structure properties.

CO2 Explain nuclear forces, spin dependence and charge independence of nuclear forces and nuclear interaction between the nucleons.

CO3 Understand nuclear reactions, nuclear reaction kinematics, nuclear chain reactions and the characteristics of nuclear fusion and fission and their applications.

CO4 Understand basic concepts and formulation for α, β and γ decays with Gamow and Fermi theories and neutrino hypothesis.

Paper IV Elementary Particle Physics

At the end of this course, students will be able to:

CO1 Understand classification of elementary particles, symmetries invariant and conservation laws.

CO2 Understand unitary symmetries in elementary particles.

CO3 Understand properties of neutrons and protons in terms of a simple Quark model.

CO4 Understand the basic principles of various nuclear particle detectors, chambers and counters.

Paper V Condensed Matter Physics

At the end of this course, students will be able to:

CO1 Understand the crystal structure in terms of crystal lattice and related concept with interaction of radiation with matter and reciprocal lattice and its applications.

CO2 Explain different types of bonding in solids.

CO3 Formulate the theory of lattice vibrations, theory of specific heat of solids and theory of metals.

CO4 Understand the concepts of crystal defects, super conductivity and magnetism.

Paper V Plasma Physics

At the end of this course, students will be able to:

CO1 Understand plasma state, different kinds of plasma and plasma parameter.

CO2 Understand magneto hydrodynamics and fluid plasma and applicability of electron

ion plasma, hydro magnetic, magneto sonic and Alfven waves.

CO3 Explain wave phenomenon in magneto plasma and concepts of ordinary and extra ordinary waves in plasma.

CO4 Explain the propagation of waves through ionosphere and magnetosphere, kinetic theory of the description of plasma, two fluid plasma and plasma resistivity.

Semester-III

Paper I Advanced Electronics I

At the end of this course, students will be able to:

CO1 Understand the Classification of IC's, Fabrication of IC's & components, Basic monolithic integrated circuit technology, processes used in monolithic technology.

CO2 Understand the Various Linear operational amplifier like Summing Amplifier, voltage follower, current to voltage, voltage to current converter, Integrator, Differentiator, Log – Antilog Amplifier, Circuit like OP-AMP 741.

CO3 Understand about Comparators, Discriminators, sample & hold circuits, Zero crossing detector, precision rectifier, waveform generators.

CO4 Explain the various multivibrators, regenerative comparator (Schmitt trigger), IC 555 timer.

Paper II Advanced Electronics II

At the end of this course, students will be able to:

CO1 Understand the digital signal processing, image processing and various modulations and digital telemetry.

CO2 Explain the Principle of optical communication, Different modes of propagation of E. M. Wave through optical fibre.

CO3 Explain the optical fibre communication and Advantages of optical communication, Light propagation in cylindrical wave guide.

CO4 Understand about various memory and optoelectronic devices.

Paper III Electrodynamics

At the end of this course, students will be able to:

CO1 Explain different electromagnetic concept and laws.

CO2 Explain Maxwell's equations and its physical consequences, electromagnetic wave propagation and EM wave equations in conducting and non-conducting medium.

CO3 Understand the covariant form and gauge invariance of Maxwell's equation, electromagnetic energy-momentum tensor and motion of charge in EM field in four vector formalism.

CO4 Understand the concept of electromagnetic radiation form accelerated charge, fields of accelerated charge, angular and frequency distributions of emitted distributions.

Paper IV Communication Electronics

At the end of this course, students will be able to:

CO1 Understand the basic modulation and demodulation schemes used in radio communication systems.

CO2 Explain propagation of radio waves such as ground wave, sky wave and space

wage propagation.

CO3 Understand the principles and operation of various antennas, TV and their design.

CO4 Understand transmission lines and aware of propagation characteristics of the electromagnetic waves in transmission lines and other wave guide structures.

Paper V Plasma Physics

At the end of this course, students will be able to:

CO1 Understand plasma state, different kinds of plasma and plasma parameter.

CO2 Understand magneto hydrodynamics and fluid plasma and applicability of electron ion plasma, hydro magnetic, magneto sonic and Alfven waves.

CO3 Explain wave phenomenon in magneto plasma and concepts of ordinary and extra ordinary waves in plasma.

CO4 Explain the propagation of waves through ionosphere and magnetosphere, kinetic theory of the description of plasma, two fluid plasma and plasma resistivity.

Semester-IV

Paper I Advanced Electronics III

At the end of this course, students will be able to

CO1 Understand the Zener regulated, IC regulated, dual polarity regulated and Switch mode regulated power supplies.

CO2 Understand the active filter and Phase locked loops.

CO3 Understand the various microwave production in microwave frequencies.

CO4 Understand the transmission, propagation, communication and microwave communication systems.

Paper II Advanced Electronics IV

At the end of this course, students will be able to:

CO1 Understand the Operation modes of analog computers, repetitive operation of computers, Time scaling, amplitude scaling, Generation of functions, Simulation of time varying systems.

CO2 Explain Digital logic families Adders & Subtractors, Magnitude comparator, Code converters, Parallel adders, Encoders, Decoders, Multiplexers, Demultiplexers, Parity bit generator and checker, Read only memory etc.

CO3 Explain the analog to digital and digital to analog convertors.

CO4 Understand about various memory elements and memory units under sequential circuits.