Program Outcome and Course Outcome

Core Courses	Course Outcomes
CC1 Mathematical Physics 1	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
CC 2 Mechanics and Fluid dynamics	1) Students learn accurately how to describe motion of objects, planetary motions, gravitation etc. Understand the motion of objects in different frame of references. 2) Know how to apply the conservation principle and symmetry of a system. 3) Understand laws of motion, reference frames, and its applications i.e. projectile motion, simple harmonic oscillator, Rocket motion, elastic and inelastic collisions. 4) Understand the idea of conservation of angular momentum, central forces effective potential. 5) Understand the application of central force to the stability of circular orbits, Kepler's laws of planetary motion. 6) 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. 7) Learn that different kinds of matter have various properties. For example, pressure, surface tension are important properties for a fluid, but stress, Modulus are important properties of solid objects. 8) Understand the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends

	and loaded in the middle. 9) Know the basics of motion of fluid which includes streamlined and turbulent flows, equation of continuity, critical velocity, flow of a liquid through a capillary tube.
CC3 Electricity and Magnetism	1) To learn about basic concepts of electrical charges and currents and their properties 2) Enhance problem solving capability based on various realistic situation 3) Understand the concept of conductors, dielectrics, inductance and capacitance. 4) Gather knowledge on the nature of magnetic materials. 5) Understand the concept of static and time varying fields. 6) Gain knowledge on electromagnetic induction and Faraday's law and its applications 7) Learn about EM waves and its propagation 8) Learn to use and solve Maxwell's equations
CC4 Waves and Optics	1) Student learn about various types of waves and their propagation. 2) To provide a basic understanding of physical and geometrical optics 3) To provide a knowledge of various optical phenomena, for example interference, diffraction, polarization etc.
CC5 Mathematical Physics II	1) Understand how to expand a function in a Fourier series. 2) Solving differential equation using power law expansion (so called Frobenius method). Learn about various special functions i.e. Legendre, Bessel functions, generating functions and their properties. 3) Fourier integral and its properties and application to signal analysis and also in quantum mechanics 4) Application of probability and various distribution functions in Physics. 5) Learn to solve partial differential equation which is very important in all branches of physics.
CC6 Thermal Physics	1) To understand the principle of calorimetry 2) Understand the basic principle and laws of Thermodynamics 3) Understand the concepts of Entropy, various thermodynamic potentials and their applications in various systems

	4) Gain knowledge about microscopic behavior of systems in explaining pressure, transport properties, viscosity, diffusion etc.
CC7 Modern Physics	
	1) To know about Radiation and its nature, old quantum theory, concept of wave-particle duality and de Broglie hypethesis. 2) 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. 3) Students learn about Nuclear structure and various models. Interaction within and with nucleus. Gamma,Beta decay. Nuclear Fission and Fusion
CC8 Mathematical Physics III	1) To study complex analysis, Cauchy Riemann conditions, Analyticity, Cauchy Integral formula, Laurent and Taylor series expansion and definite integrals using contour integration. 2) To learn variational calculus. Lagrangian and Hamiltonian formulation, Euler-Lagrange equation, Use of symmetry and conservation laws. 3) To understand special theory of relativity, length contraction, time dilation, mass-energy relation etc. This is one of the corner stone of modern physics.
CC9 Analog Electronics	1) To know basic boolean principle and how various electronic instruments work based on this 2) To motivate the students to apply the principles of electronics in their day-to-day life. 3) Learn various network theorems, diodes and their application 4) Study various theory and working principles of transistors, regulated power supply, amplifiers, concept of feedback, OPAMP, Multivibrators and Oscillators
CC10 Quantum Mechanics	1) One of the most important subject in undergraduate course. Students solve various various quantum mechanical features by solving various potentials: example, Finite and infinite well, Harmonic oscillator 2) Learn Quantum theory of Hydrogen

	atoms, solution of Schrodinger equation under central force, Orbital angular momentum and spin angular momentum 3) To know generalized angular momenta, Electron's magnetic moment, Energy of a magnetic dipole, Stern-Garlach experiment 4) To study Fine structure of hydrogen atoms, atoms in presence of electric and magnetic fields-- application of Quantum mechanics for atomic systems 5) To learn Many electron atoms, identical particles, Pauli principle.
CC11 Electromagnetic Theory	1) Learn Maxwell's equations, gauge transformations, Pyonting vector, Electromagnetic field energy density, momentum density etc. 2) Propagation of electromagnetic wave through medium 3) Polarization
CC12 Statistical Mechanics	1) To understand statistical properties of matter, connections with thermodynamics 2) To use these theory in practical systems (ideal gas, Bose and Fermi systems), Identical particles 3) To learn Bose-Einstein statistics, and its application, Fermi-Dirac statistics and its application
CC13 Digital systems and applications	1) To learn integrated circuits(IC), number system and Boolean description, introduction to logic systems, various Gates 2) To understand product and sum in logical expression, conversion between truth table and logical expression, Karnaugh map 3) To learn how to Implement different circuits: adder, subtractor, idea of multiplexer, demultiplexers, encoder, decoder 4) To know registers and counters, computer organization, data conversion.
CC14 Solid State Physics	1) To learn crystal structure, lattice dynamics 2) To understand quantum properties of matter like magnetic property, dielectric property 3) To understand elementary band theory 4) Superconductivity – one of major breakthrough in modern science

Departmental Specific Elective Subjects (DSE)	Course outcomes
DSEA1(a) Advanced Mathematical Methods	1) To learn Linear Algebra and vector space 2) To understand tensors and tensor algebra 3) To know group theory and its application
DSEA1(b) Laser and Fiber Optics	1) To know theory of laser, its basic properties 2) To learn about resonators, transient effect, many laser systems and practical use of laser 3) to understand
DSEB1 (a) Astronomy and Astrophysics	1) Gain knowledge on various tools of astronomy, basic introduction of starts, galaxies, interstellar medium, mass and length scales of astronomy 2) To learn observational tools of astronomy 3) To understand star and other stellar systems, formation and evolution of stars 4) To know about the galaxies and its components 5) To learn basics of cosmology, redshift, field equations and accelerating universe
DSEB1 (b) Nulcear and Particle Physics	1) To learn general properties of nuclei, various nuclear models, radioactivity 2) To understand nuclear reactions and interaction of nuclear radiation with matter 3) To know about the detectors for nuclear radiations and particle accelerators 4) To learn and understand fundamentals of particle physics.
DSEA2 (a) Nano Materials and applications	1) To learn about nanoscale systems, their band structures, application of Schrodinger equation for such nano structures 2) To know how to synthesis nano materials and how to characterize them 3) To know various properties of nano materials, e.g. optical and electrical (transport) properties
DSEA2(b) Advanced Classical Dynamics	1) To understand calculus of variation 2) To learn about small oscillations 3) To understand about rigid body motion 4) To know about non-linear dynamics
DSEB2(a) Communication Electronics	1) To introduce students to basics of electronic communication 2) To learn analog modulations and to modulate analog pulse 3) To learn how to modulate digital pulse 4) Students are introduced to communication and navigation system, which has many modern day applications.

DSEB2(b) Advanced Statistical Mechanics	1) To review classical statistical mechanics 2) To understand Quantum Statistical Mechanics 3) To learn ideal Bose and Fermi systems 4) To learn Ising model and non-equilibrium statistical mechanics

Skill Enhancement Courses (SEC)	Course outcomes
SEC A-1 Scientific Writing	Students learn Latex, a program system to write scientific papers and documents, how to insert various mathematical symbols, how to insert a figure or a table in a document
SEC A-2 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
SEC B-1 Arduino	Students learn Arduino, which is basically an open-source electronics proto-type which itself can be used as a circuit
SEC B-2 Electrical Circuits and Network Skills (generators, transformers, AC motor etc).	Students know about various electrical instruments

Practical Topics	Course outcomes
Practicals of Mechanics, Thermodynamics, Electricity and Magnetism, Waves, Optics, Modern Physics	1) Various theories which students learn in theory lesson are verified in practical classes. 2) Students learn various practical situation, how to handle tools and instruments, measurement techniques, graph plotting, statistical/error estimations etc. 3) 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)	1) Understand how to write an algorithm, iteration techniques 2) Various numerical methods to solve many problems numerically. e.g. finding solution of a equation, integration and differentiation etc. 3) Plotting different kinds of graphs, how to label them etc.

Program Specific Outcome (PSO)	1) Physics deals with a wide variety of 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 an 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. 2) Physics uses mathematics as a medium to organize and formulate experimental results. Students gather handsome knowledge on mathematics required for formulating and solving problems. 3) Students learn to perform various types of numerical calculations. 4) Students have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusions. 5) Students will develop good oral and written scientific communication skill. 6) Students learn to think critically and work independently.
Program Outcome (PO)	1) The course structure has been prepared in such a way so as the students learn and understand how the various physical phenomena take place based on their already acquired knowledge. Solving problems based on realistic situation make them understand how various physical systems in everyday life works. Therefore, the course not only introduce some abstract knowledge, but instill basic need-based knowledge as well. 2) The main cognitive outcome of the program is that the student should be able to explain an otherwise unknown situation/problem on their own based on what they have learnt. 3) Another important part of the program is its mathematical rigour. Students learn how to solve problems and prove various theorems. This has an enormous effect in their behavioral outcome. The students learn to analyze situation in a more logical and coherent way. This also instills the quality of accepting a particular

knowledge/information based on facts available.

4) 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.

5) Students are well prepared for cutting edge research activity for example, Nano Sacience, Astrophysics, Nuclear and Particle Physics, Condensed Matter Physics etc.