Yogoda Satsanga Mahavidyalaya

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(NACC Accredited, Grade: B++, CGPA: 2.89)

COURSE OUTCOME OF PHYSICS DEPARTMENT

Semester	Course Code	Course Name	Course Outcome
Semester-1	CC1	**Mathematical Physics**	CO1: Revise the knowledge of calculus, vectors, vector calculus, probability and probability distributions. These basic mathematical structures are essential in solving problems in various branches of Physics. CO2: Different Techniques to solve differential and integral equations. CO3: Training in mathematical tools like calculus, integration, series solution approach, special function will prepare the student to solve ODE; PDE's which model physical phenomena.
	CC-2	**Mechanics**	CO1: Learn about relative motion. Inertial and non-inertial reference frames. To understand the negative result of Michelson Morley experiment, Galilean and Lorentz transformation. Parameters defining the motion of mechanical systems and their degrees of freedom. Study of the interaction of forces between solids in mechanical systems. Centre of mass and inertia tensor of mechanical systems. CO2: Application of the vector theorems of mechanics and interpretation of their results. CO3: Newton's laws of motion and conservation principles. Introduction to analytical mechanics as a systematic tool for problem solving. To Study the behavior of rigid body dynamics CO4: To Describe oscillatory motion with graphs and equations, and use these descriptions to solve problems of oscillatory motion. Understand the physics and mathematics of oscillations. Solve the equations of motion for simple harmonic, damped, and forced oscillators. CO5: To Study of bending behavior of beams and analyze the expression for young's modulus, to understand the surface tension and viscosity of fluid, to understand the dynamics and gravitation.

Semester-2	**CC3-**	**Electricity and Magnetism**	CO1: Students will be able to understand the concept of the electric force, electric field and electric potential for stationary charges. They are able to calculate electric potential and electric field by using Gauss's law. CO2: Student will understand the dielectric phenomenon and effect of electric field on dielectric. CO3: Study the concept of magnetic field, magnetic field for steady currents using Biot-Savart's and Ampere's Circuital laws. CO4: Student will learn magnetic materials and its properties. CO5: Learning Maxwell's equations and boundary value problems. Applications of these equations for solving problems. Understand the basic mathematical concepts related to electromagnetic vector fields.
	CC-4	**Wave and Optics**	CO1**:** The student will get an introduction to the discipline of optics and its role in the modern society. The student shall master the geometrical approximation, including Guass thin lens formula, Fermat's and Huygen's principles, and the paraxial matrix formalism for refractive and reflective surfaces. CO2: The student will be able to analyze typical optical imaging systems, with emphasis on the human eye, the camera, the telescope and the microscope. CO3: The wave optics part of the course will give the student a basic knowledge within interferometry, polarization, diffraction, and the basics of coherent and non-coherent light sources. CO4: The student shall become able to analyze and calculate interference between plane waves and spherical waves, reflection and transmission of plane waves, and optical wave guiding within thin plates and optical fibers. CO5: The student shall understand how the polarization of light changes at reflection and transmission at interfaces The student shall know the conditions for near and far-field diffraction and be able to calculate the far-field diffraction from gratings and simple aperture functions. CO6: Learn the fundamentals of harmonic oscillator model, including damped and forced oscillators and grasp the significance of terms like quality factor and damping coefficient. Study the general equation of wave motion in general and TM waves in stretched strings and longitudinal waves in gases. Familiarise with general

			terms in acoustics like intensity, loudness, reverberation etc, and study in detail about production, detection, properties and uses of ultrasonic waves.
Semester-3	**CC5**	**Mathematical Physics**	CO1: Basic and advanced mathematical tools required for Physics Problems, Different Techniques to solve differential and integral equations, Various special functions and important transforms and their applications. CO2: Solve differential equations like Legendre, Bessel and Hermite that are common in physical sciences CO3: Solve the different partial differential equations encountered in physical problems and draw inferences from solutions.
	CC-5	**Heat and Thermodynamics**	**CO1:** Understand thermodynamic terminology correctly, explain fundamental thermodynamic properties., Derive and discuss the first and second laws of thermodynamics. Solve problems using the properties and relationships of thermodynamics. Analyze basic thermodynamic cycles. CO2: The course aims through a theoretical and experimental approach to give a fundamental understanding of how systems in thermal equilibrium can be described by thermodynamics, kinetic gas theory and basic statistical mechanics. Knowledge. CO3: To analyze problems in thermal physics using mathematical and numerical methods,
	CC-6	**Digital electronics**	CO1: Became familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from to others. CO2: Learn the minimization techniques to simply the hardware requirements of digital circuits, implement it, design and apply for real time digital systems. CO3: Understand the working mechanism and design guidelines of different combinational, sequential circuits and their role in the digital system design. CO4: Became able to know various types of components-ADC and DAC, memory elements and the timing circuits to generate different waveforms, and also the different logic families involved in the digital system.
Semester-4	**CC8**	**Mathematical Physics**	CO1: Basic and advanced mathematical tools required for Physics Problems, Different Techniques to solve differential and integral equations, Various special functions and important transforms and their applications. CO2: Understand and apply the concept of Fourier series. CO3: Understand and apply different types of Integral transforms like Fourier and Laplace.

	CC-9	**Modern Physics**	CO1**:** Understand the intuitive ideas of the Relativity, Quantum physics, and Nuclear physics. CO2: Understand the basic principles of 20th-century Physics including but not limited to Einstein theory of Relativity, Quantum theory of light, Particle nature of matter, Quantum mechanics in one dimension, Basic ideas of nuclear physics and its applications. CO3: Explain radioactivity and discuss different aspects of nuclear energy in nuclear reactors and in the universe. CO4: Discuss the nature of light and the electromagnetic spectrum and outline practical applications.
	CC-10	**Analog electronics**	CO1: To give knowledge of some basic electronic components and circuits. To learn the difference between conductor, insulator and semiconductor, to study basics of semiconductor and devices and their applications in different areas, to study the basics of transistor and its working and implementation CO2: To study different biasing techniques to operate transistor, FET, to know the principle of operation of photo-electronic devices like photodiode, and LED, CO3: To contemplate with the multistage amplifier, to examine CMRR like common mode gain and difference mode gain, to describe DC load line and bias point and different biasing circuits. CO4: To understand and analyse the IC 741 operational amplifier and its characteristics
	SEC2	**Electrical circuit network skills**	CO1: Learn about working of multimeters, voltmeters, ammeters, electric circuit elements. CO2: Learn about construction and working of dc power sources, ac/dc generators, inductors, capacitors, transformers, single phase and three phase motors, interfacing dc/ac motors to control and measure, relays, fuse and switches. Co3: Learn basics of electrical wiring
Semester-5	**CC11**	**Quantum Mechanics and Application**	CO1: Physical Interpretation of Wave function, Schrödinger's Wave Equation, Eigen Function and Eigen values CO2: Free Particle, One Dimensional and Three Dimensional Rigid Box, Potential Barrier CO3: Spherically symmetric potential, Examples of Rigid Rotor and hydrogen atom CO4: Hermition and other operators in Quantum Mechanics, Commutator brackets and concept of parity

			CO5: Linear vector spaces, Hilbert space, concepts of basis and operators and bra and ket notation CO6: Theory of angular momentum and spin matrices, orbital angular momentum
	CC-12	**Solid State Physics**	CO1: A brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials. Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids. CO2: Knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss, understanding about the dielectric and ferroelectric properties of materials. CO3: Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors. CO4: Understand the basic idea about superconductors and their classifications.
	DSE1	**Nuclear and Particle Physics**	CO1: Understand the ground state properties of a nucleus – the constituents and their properties, mass number and atomic number, relation between the mass number and the radius and the mass number, average density, range of force, saturation property, stability curve, the concepts of packing fraction and binding energy, binding energy per nucleon vs. mass number graph, explanation of fusion and fission from the nature of the binding energy graph. CO2: Understand the nuclear models and their roles in explaining the ground state properties of the nucleus –(i) the liquid drop model, its justification so far as the nuclear properties are concerned, the semi-empirical mass formula, (ii) the shell model, evidence of shell structure, magic numbers, predictions of ground state spin and parity, theoretical deduction of the shell structure, consistency of the shell structure with the Pauli exclusion principles. CO3: Understand about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays, the properties of the constituents of these rays and the mechanisms of the emissions of these rays, outlines of Gamow's theory of alpha decay and Pauli's theory of beta decay with the neutrino hypothesis, the electron capture, the fine structure of alpha particle spectrum, the Geiger-Nuttall law, the radioactive series.

			CO4: Understand the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws, CO5: Understand about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the solid state and semiconductor detectors.
	DSE2	**Classical Dynamics**	CO1: Understand the knowledge of the Newtonian, the Lagrangian and the Hamiltonian formulations of classical mechanics and their applications in appropriate physical problems. CO2: learn the special theory of relativity- postulates of the special theory of relativity, Lorentz transformations on space-time and other four vectors, four-vector notations, space-time invariant length, length contraction, time dilation, mass-energy relation, Doppler effect, light cone and its significance, problems involving energy momentum conservations. CO3: Learn the retarded potentials, potentials due to a moving charge, Lienard Wiechert potentials, electric and magnetic fields due to a moving charge, power radiated, Larmor's formula and its relativistic generalization.
Semester-6	**CC13**	**Electromagnetic theory**	CO1: Understanding the Maxwell's equations, role of displacement current, gauge transformations, scalar and vector potentials, Coulomb and Lorentz gauge, boundary conditions at the interface between different media. CO2: Apply Maxwell's equations to deduce wave equation, electromagnetic field energy, momentum and angular momentum density. Analyse the phenomena of wave propagation in the unbounded, bounded, vacuum, dielectric, guided and unguided media. Understand the laws of reflection and refraction and to calculate the reflection and transmission coefficients at plane interface in bounded media. CO3: Understand the linear, circular and elliptical polarisations of em waves. Production as well as detection of waves in laboratory. Understand propagation of em waves in anisotropic media, uni-axial and biaxial crystals phase retardation plates and their uses. CO4: Understand the concept of optical rotation, theories of optical rotation and their experimental rotation, calculation of angle rotation and specific rotation. Understand the fundamentals of propagation of electromagnetic waves through optical fibres and calculate numerical apertures for step and graded indices and transmission losses

	CC-14	**Statistical Mechanics**	CO1: Understand the concepts of microstate, macrostate, ensemble, phase space, thermodynamic probability and partition function. Study the combinatoric studies of particles with their distinguishably or indistinguishably nature and conditions which lead to the three different distribution laws e.g. Maxwell-Boltzmann distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles and their derivation. CO2: Understand the application of the classical statistical mechanics to derive the law of equipartition of energy and specific heat. Understand the Gibbs paradox, equipartition of energy and concept of negative temperature in two level system. CO3: Learn to derive classical radiation laws of black body radiation. Wiens law, Rayleigh Jeans law, ultraviolet catastrophe. Saha ionization formula. CO4: Learn to calculate the macroscopic properties of degenerate photon gas using BE distribution law, understand Bose-Einstein condensation law and liquid Helium. Bose derivation of Plank's law, Understand the concept of Fermi energy and Fermi level, calculate the macroscopic properties of completely and strongly degenerate Fermi gas, electronic contribution to specific heat of metals. CO5: Understand the application of F-D statistical distribution law to derive thermodynamic functions of a degenerate Fermi gas, electron gas in metals and their properties.
	DSE3	**Project**	
	DSE4	**Experimental techniques**	CO1: Learn about accuracy and precision, different types of errors and statistical analysis of data. And about Noise and signal, signal to noise ratio, different types of noises and their identification. CO2: Learn the concept of electromagnetic interference and necessity of grounding, about transducers and basic concepts of instrumentation - Different types of transducers and sensors. CO3: Learn about the construction and working of a digital multimeter. CO4: Vacuum systems including ultrahigh vacuum systems.