Department of Physics

PROGRAMME NAME : *B.Sc PHYSICS*

PROGRAMME OUTCOMES

PO 1	Acquire a fundamental concepts in the field of Physics and procedural knowledge that creates different types of professionals related to the subject area of Physics, including professionals engaged in research and development, teaching and government / public service.
PO 2	Demonstrate the ability to use skills in Physics and its related areas of technologies for formulating and tackling Physics related problems
PO 3	Inculcate innovative skills and teamwork among students to meet societal expectations.
PO 4	Perform analysis to assess, interpret and create innovative ideas through practical experiments.
PO 5	Facilitate to enter multidisciplinary path to solve day-to-day scientific problems.
PO 6	Carry out fieldworks and projects both independently and collaboration with others and to report in a constructive way.
PO 7	Improve communication ability and knowledge transfer through ICT aided learning integrated with Library resources.
PO 8	Attain competency in job market / entrepreneurship.

SL. NO.	COURSE NAME	COURSE OUTCOME	
1	PROPERTIES OF MATTER & MECHANICS	CO 1	Define Stress, Strain, Poisson's ratio, Hooke's law, Torsion pendulum and determine the elastic constant by Searle's Method.
		CO 2	Understand the principle of elasticity through the study of young's Modulus and Rigidity Modulus.
		CO 3	Derive the Expression for the Bending Moment, Cantilever depression, Uniform and Non-Uniform Bending.
		CO 4	Find the Young's Modulus of a bar by Uniform and Non-Uniform Bending Method
		CO 5	Analyse the different Molecular Forces that causes tension on the surface of liquid and determine the surface tension by Capillary rise method and Quincke's Method

		CO 6	Determine the Coefficient of Viscosity of a liquid by Poiseuille's Method and apply the knowledge of viscosity in the field of lubrication
		CO 7	Understand the Analogy between translational and Rotational Motion, Angular Momentum, Angular Impulse, Moment of Inertia and Radius of gyration
		CO 8	Understand Newton's Second Law for rotation and determine the expression for rotational kinetic energy and power during rotation.
		CO 9	Analyse the centre of pressure on a rectangular and triangular laminar.
		CO 10	Understand the law of floatation and determine the Meta Centric height of a ship and apply the principle of Bernoulli's Theorem in Pitot's tube and Venturimeter
2	ALLIED PHYSICS– I	CO 1	Define the fundamentals of elasticity, concept of stress, strain, bending moment and to solve the problems related.
		CO 2	Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.
		CO 3	Understand principles of surface tension and Viscosity
		CO 4	Describe the properties of fluids such as viscosity and surface tension and evaluate the value of coefficient of viscosity
		CO 5	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
		CO 6	Determine the frequency of tuning fork by Melde's string experiment and apply the knowledge of simple harmonic motion.
		CO 7	Understand the laws of thermodynamics, concepts of transport phenomena.
		CO 8	Demonstrate the experiments to determine the thermal conductivity and specific heat capacity and apply the knowledge of transport phenomena.

		CO 9	Acquire mastery of the fundamental principles and applications of interference, diffraction and polarization
		CO 10	Demonstrate the experiments to find the wavelength of different colours of light by normal incidence using grating and apply the knowledge of diffraction principle.
3	OPTICS AND ACOUSTICS	CO 1	Understand the concepts of spherical aberration, chromatic aberration in lenses, refraction, deviation and dispersive power of a prism.
		CO 2	Acquire knowledge of the working principle of constant deviation spectroscope and different types of eyepieces.
		CO 3	Discuss the theory of interference fringes and interference in thin films
		CO 4	Apply the phenomenon of interference on optical experiments like air wedge, Newton's rings and Michelson's interferometer.
		CO 5	Define diffraction, polarization, double refraction and optical activity
		CO 6	Understand the theory of diffraction by a single slit, diffraction by a circular aperture, theory of grating and theory of different types of polarized light.
		CO 7	Acquire knowledge of simple harmonic motion, damped and forced vibrations, musical notes and musical scale.
		CO 8	Describe the principle and working of acoustic instruments like Helmholtz resonator, sonometer and Melde's apparatus.
		CO 9	Understand the properties, applications, production and detection of ultrasonic waves
		CO 10	Derive Sabine's formula and apply it to design the acoustically good auditorium and architectures.

4	ALLIED PHYSICS - II	CO 1	Apply Ohm's Law and construct the resistors in series & parallel
		CO 2	Analyse the conversion of Galvanometer into Ammeter and Voltmeter
		CO 3	Analyse the properties of magnetism and to classify the Dia, Para and Ferromagnetic materials
		CO 4	Analyse Faraday's Law of Electromagnetic Induction and to determine the mutual induction using BG
		CO 5	Identify and analyse the uses of junction diodes and to analyse the characterization of Zener diode and transistors
		CO 6	Evaluate the basic logic gates such as NAND, NOR, EX-OR, and to prove De-Morgan's Law
		CO 7	Analyse the classification of nuclei and the properties of nucleus
		CO 8	Analyse and apply the fundamental laws of radioactivity
		CO 9	Demonstrate the projectiles and to calculate the time of flight
		CO 10	Analyse and apply Galilean and Lorentz transformation equations
5	ELECTRICITY & ELCTROMAGNETISM	CO 1	Understand the basics and applications of Coulomb's law, Gauss' law and thermoelectric effects
		CO 2	Explain the Kohlrausch's bridge method for determining the specific conductivity of an electrolyte.
		CO 3	Understand Ohm's law, Kirchoff's laws, growth and decay of current and charge in different circuits.
		CO 4	Analyse LCR series resonance and LCR parallel resonance circuits with derivation.
		CO 5	Understand the about magnetic vectors, B-H curve and Lorentz force.
		CO 6	Explain the construction, working and application of moving coil Ballistic galvanometer and DeSauty's bridge.

		CO 7	Understand the concepts of Faraday's laws, Owen's bridge and coefficient of coupling.
		CO 8	Use of Earth inductor for finding horizontal component and vertical component of the Earth's magnetic field
		CO 9	Derive the Maxwell's equations for material medium and for free space.
		CO 10	Explain the concepts of Hertz experiment for production and detection of EM waves and to understand Poynting vector and displacement current.
6	ALLIED PHYSICS– I	CO 1	Define the fundamentals of elasticity, concept of stress, strain, bending moment and to solve the problems related.
		CO 2	Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.
		CO 3	Understand principles of surface tension and Viscosity
		CO 4	Describe the properties of fluids such as viscosity and surface tension and evaluate the value of coefficient of viscosity
		CO 5	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
		CO 6	Determine the frequency of tuning fork by Melde's string experiment and apply the knowledge of simple harmonic motion.
		CO 7	Understand the laws of thermodynamics, concepts of transport phenomena.
		CO 8	Demonstrate the experiments to determine the thermal conductivity and specific heat capacity and apply the knowledge of transport phenomena
		CO 9	Acquire mastery of the fundamental principles and applications of interference, diffraction and polarization

		CO 10	Demonstrate the experiments to find the wavelength of different colours of light by normal incidence using grating and apply the knowledge of diffraction principle.
7	MAINTANANCE OF ELECTRICAL APPLIANCES	CO 1	Understand the operations and safe handling ofcommonly used domestic appliances.
		CO 2	Understand the basic ideas about the components used in electrical appliances.
		CO 3	Understand a basic knowledge of electricity and magnetism.
		CO 4	Understand and apply knowledge to design and troubleshoot the electrical circuits.
		CO 5	Understand the basic ideas about transformers and their types and working principles.
		CO 6	Understand the concepts underlying the operation of AC and DC circuits.
		CO 7	Describe the concept of household circuits and their wiring systems in detail.
		CO 8	Understand the earthing and colour coding of the wires.
		CO 9	Managing the appliances with safety precautions using switches and fuses
		CO 10	Understand the basic ideas behind inverters, motors, and generators.
8	INSTRUMENTATION PHYSICS - I	CO 1	Name the Physical quantities and define its use.
		CO 2	Recall and recognize the units of physical quantities
		CO 3	Compare the different types of errors. Differentiate average & standard deviation
		CO 4	Calculate arithematic mean & its deviation
		CO 5	Classify the electrode materials & differentiate them

		CO 6	Design the forms of electrodes
		CO 7	Recall instruments used commonly in medical field Identify the instrument
		CO 8	Compare digital &analog instruments Distinguish EEG& ECG
		CO 9	Classify the types of displays Design a simple circuit using LED
		CO 10	Infer the use of LCD Explain incandescent display.
9	BASIC PHYSICS-I	CO 1	Recall the definition of speed, velocity and acceleration
		CO 2	Apply the principle of work, power and energy in any one daily activity.
		CO 3	List out the applications of Bernouille's theorem
		CO 4	Analyse the functioning of aventurimeter and Pitot's tube
		CO 5	Summarize the effect of reverberation in buildings
		CO 6	Create a method to produce and detect plane polarized light
		CO 7	Enumerate the different types of resistances
		CO 8	Construct Wheatstone's bridge using Kirchoff's law
10	APPLIED PHYSIC	CO 1	Explain about the conventional energy Sources
		CO 2	Illustrate about the world's reserve of conventional energy. To classify various forms of energy.
		CO 3	Summarize about fossil fuels such as coal, oil and natural gas and their availability, statistical details.
		CO 4	Explain about fossil fuel's application and to list out the merits and demerits.
		CO 5	Illustrate about Bio mass energy and Biomass classification and to elaborate the Bio Mass Conversion process

		CO 6	Summarize about Dheena Bandhu Model gas plant. They can explain the importance of wood gasification, Also to list out the merits and demerits of Bio Mass
		CO 7	Demonstrate about the renewable energy resources Such as solar energy and their applications
		CO 8	Elaborate about solar pond, solar water heater, solar cookers, solar green house and solar cell
		CO 9	Illustrate about Geothermal energy and Geo thermal power plant. Summarize about the wind energy, wind farms and wind mill.
		CO 10	Explain the process of producing energy from tides and energy from waves
11	Heat and thermodynamics	CO 1	Acquire the knowledge of Joule-Kelvin effect, liquefaction of hydrogen and helium gases and adiabatic demagnetization.
		CO 2	the practical applications of the low temperature concepts to refrigerator, air-conditioning machine and super fluidity
		CO 3	Derive the expressions for pressure, gas laws, Maxwell's law of distribution of molecular velocities, viscosity and thermal conductivity
		CO 4	Derive and determine the Vander Wall's constants and critical constants.
		CO 5	Explain the heat experiments like Forbe's method and Lee's disc method for finding thermal conductivity.
		CO 6	Understand the concepts of black body radiation, Wien's law, Stefan's law and Newton's law of cooling
		CO 7	Acquire the knowledge of Zeroth law, I and II law of thermodynamics, gas equation and Carnot's theorem

		CO 8	Apply the laws of thermodynamics to Carnot's engine, Otto engine and Diesel engine to find efficiency
		CO 9	Derive the Clausius-Clapeyron equation and second latent heat equation and specific heat relation
		CO 10	Understand the concepts of III law of thermodynamics, entropy and to derive Maxwell's thermo dynamical relations.
12	ALLIED PHYSICS - II	CO 1	Apply Ohm's Law and construct the resistors in series & parallel
		CO 2	Analyse the conversion of Galvanometer into Ammeter and Voltmeter
		CO 3	Analyse the properties of magnetism and to classify the Dia, Para and Ferromagnetic materials
		CO 4	Analyse Faraday's Law of Electromagnetic Induction and to determine the mutual induction using BG
		CO 5	Identify and analyse the uses of junction diodes and to analyse the characterization of Zener diode and transistors
		CO 6	Evaluate the basic logic gates such as NAND, NOR, EX-OR, and to prove De-Morgan's Law
		CO 7	Analyse the classification of nuclei and the properties of nucleus
		CO 8	Analyse and apply the fundamental laws of radioactivity
		CO 9	Demonstrate the projectiles and to calculate the time of flight
		CO 10	Analyse and apply Galilean and Lorentz transformation equations
13	MAINTANANCE OF ELECTRONIC APPLIANCES	CO 1	Understand the basic ideas about the components we use in electronic appliances.
		CO 2	Recognize resistors, capacitors, and connection systems.
		CO 3	Understand the fundamentals of measuring instruments. 1

		CO 4	Understand oscilloscopes and their various types.
		CO 5	Understand the classification of active and passive transducers and their types.
		CO 6	Understand about the transducer's applications, merits, and demerits.
		CO 7	Understand the basic concepts of communication devices and their working principles.
		CO 8	Understand the principles of operation of modern technology communication devices.
		CO 9	Learn about photography by using cameras and their accessories.
		CO 10	Learn about shutter speed, resolution, filters, and the use of various lenses in cameras.
14	INSTUMENTATION Physics II	CO 1	Recall the use of multimeters. Compare the analog& digital technique
		CO 2	Deduct the use of measurements of frequency & time interval
		CO 3	Categorize the various types of transducers. Make use of experiments using them
		CO 4	Conclude the various uses of transducers
		CO 5	Compare optical & electron microscope Define their uses
		CO 6	Conclude the uses of SEM & TEM
		CO 7	Identify the X- Ray pattern Relate fluoroscopy & radiography
		CO 8	Experiment with computers in medicine
		CO 9	Explain Oscilloscope List their uses
		CO 10	Formulate the features of CRT
15	BASIC PHYSICS-II	CO 1	Recall the structure of nuclei
		CO 2	Explain the properties of alpha, beta and gamma rays
		CO 3	Enumerate the applications of para, dia and diamagnetic materials

		CO 4	Analyse the role of superconductors in the present technology
		CO 5	Weigh the use of Laser technology in medicinal field
		CO 6	Explain the postulates of special theory of relativity
		CO 7	Differentiate between analog and digital circuits
		CO 8	Design a logic circuit for the addition of two binary numbers
16	SPACE PHYSICS	CO 1	Explain about universe planets. Also to imagine and classify interior and exterior planets
		CO 2	Illustrate about Van Allen Belts and to summarize about auroro
		CO 3	Classify and illustrate about comets, Meteors, Asteroids
		CO 4	Elaborate the salient features of asteroids, meteors and its uses
		CO 5	Describe about sun. To list out the structure of photosphere, chromosphere, Corona.
		CO 6	Elaborate the satellites of planets their structure. Interpret the phases and features of moon
		CO 7	Explain about star constellation. Also to discuss about binary stars and their origin.
		CO 8	Classify the types of clusters, types of variable, types of galaxies
		CO 9	Summarize the origin of universe.
		CO 10	Illustrate about the Big Bang Theory, Pulsating Theory, Steady state theory.
17	Basic Electronics	CO 1	Differentiate between constant voltage source and constant current source
		CO 2	Explain Norton's theorem and Thevinin's theorem
		CO 3	Design a voltage regulator using Zener diode
		CO 4	Consruct a half wave bridge rectifier using diodes and capacitors
		CO 5	Explain the forward bias and reverse bias action of a transistor

		CO 6	Analyse the circuit of aastable and monostable multivibrator
		CO 7	Explain the working of a Hartley and Colpitts Oscillator
		CO 8	Design the circuit for low and high pass filter and explain the frequency response curve
18	SPECTROSCOPY	CO 1	Explain different types of motion. Classify molecules according to rotational modes.
		CO 2	Discriminate the effect of isotopic substitution
		CO 3	Discuss the 3 IR regions. Justify the interaction of rotations & vibrations on molecules.
		CO 4	Analyzed the IR techniques & explain its importance in research
		CO 5	Distinguish Rayleigh & Raman scattering Categorize classical & quantum theory of Raman effect
		CO 6	Validate the rule of mutual exclusion
		CO 7	Formulate Lamber- Beer Law & Calculate transmission from absorbance
		CO 8	Relate the use of UV spectrum in research
		CO 9	Explain magnetic resonance & its principles
		CO 10	List the uses of MRI Interpret NMR spectra
19	Atomic and Nuclear Physics	CO 1	Understand the concepts of free electron theory, band theory and positive rays.
		CO 2	Derive the expressions for electrical conductivity, thermal conductivity and to explain Hall effect and Hall coefficient
		CO 3	ain the vector atom model, coupling schemes and Zeeman effect.
		CO 4	yse the -4 Stern and Gerlachexperiment with derivation.
		CO 5	Understand the production, properties, usage of Xrays and various X-ray diffraction methods.

		CO 6	Explain the basics of primary and secondary cosmic rays, cosmic ray shower and Van Allen belts.
		CO 7	the general properties of nucleus by using liquid drop model and shell model and to understand laws of radioactivity
		CO 8	Explain the construction, working and application of G.M.counter, Wilson cloud chamber, Cyclotron and betatron.
		CO 9	Apply the concepts of nuclear fission and fusion to atom bomb and hydrogen bomb.
		CO 10	Classify the elementary particles with examples and understand the concept of quark model.
20	PROGRAMMING IN C++	CO 1	Understand the basics of C++ programming.
		CO 2	Understand the applications of C++ modules.
		CO 3	Understand the basic techniques of numerical analysis.
		CO 4	Understand and apply computational techniques to physical problems.
		CO 5	Understand the procedural and object-oriented paradigms with concepts like streams, classes, functions, and arrays.
		CO 6	Understand dynamic memory management techniques using member functions, classes, constructors, etc.
		CO 7	Understand the concept of function overloading and operator overloading.
		CO 8	Understand inheritance and its types of inheritance.
		CO 9	Managing the C++ streams with operations and classes
		CO 10	Understand the fundamental C++ file operations for single and multiple files.

21	COMMUNICATION ELECTRONICS	CO 1	Analyse amplitude modulation and AM envelope. To explain AM frequency bandwidth and phasor representation of AM with carrier.To determine the coefficient of modulation or percentage modulation or modulation index.
		CO 2	illustrate AM power distribution and AM current relation and efficiency. Elaborate emitter modulations or low power AM collector modulator.Classify low level transmitter and high level transmitter
		CO 3	Analyze the comparison of AM system and Quadrature amplitude modulation. To illustrate the Principles of AM detection and AM receivers
		CO 4	Explain about tuned radio frequency receiver or straight receiver. To elaborate double frequency conversion AM receiver.
		CO 5	Illustrate Frequency modulation and phase modulation. To determine phase modulation and modulation index.
		CO 6	Elaborate the conversion of FM to PM and they can picturize the phasor representation of FM and PM. To compare AM and FM
		CO 7	Explain and Analyze FM detectors and balanced slope detector
		CO 8	Illustrate the ratio detector and to elaborate the important features of FM super heterodyne receiver and FM noise suppression. Also to summarize about threshold extension by FMFB technique
		CO 9	Elaborate about BFSK and to summarize about Binary phase shifting Key. The importance of Quadrature PSK and Differential PSK.
		CO 10	Comparison of digital modulations can be done.to compare and classify correlative coding and Duo binary encoding.
22	Quantum Mechanics	CO 1	Understand the quantum concepts of black body radiation, Planck's theory and photoelectric effect.
		CO 2	the Bohr's quantization concept of angular momentum to hydrogen atom.

		CO 3	Acquire the knowledge of De Broglie's hypothesis and concepts of phase and group velocities.
		CO 4	ain the concepts of diffraction and interference of electrons and wave packet
		CO 5	Understand the Heisenberg's uncertainty principle and its proof between energy and time.
		CO 6	rate some thought experiments to explain the Heisenberg's uncertainty principle.
		CO 7	Derive Schrodinger's time-dependent and timeindependentwave equations.
		CO 8	Understand the concepts of wave function, eigenfunction, eigen value, operators and postulates of quantum mechanics.
		CO 9	Apply the concepts of quantum mechanics to particle in one-dimensional box and to particle in a rectangular three-dimensional box
		CO 10	Acquire knowledge of application of quantum mechanics to simple harmonic oscillator and transmission across a potential barrier.
23	Digital Electronics	CO 1	Define binary number
		CO 2	Differentiate the various codes in Binary system
		CO 3	Construct the circuit for the basic logic gates
		CO 4	Explain the half and full subtractor using logic gates
		CO 5	Draw the circuit for frequency divider
		CO 6	Analyse the circuit of aastable and monostable multivibrator
		CO 7	Explain the function of a multiplexer and De- multiplexer
		CO 8	Differentiate A/d and D/A converter

24	Solid State Physics	CO 1	Explain the seven classes of crystals and to illustrate about the Bravais lattice in three dimensions.
		CO 2	Imagine and elaborate about Simple cubic, Face centered cubic, Body centered cubic and Hexagonal closed packed structures. To make use of Braggs's law and reciprocal lattice to SCC, BCC and FCC lattices.
		CO 3	Illustrate Langevin's theory of Paramagnetism, Weiss Paramagnetism. To analyze the concept of Ferromagnetism and to summarize about domain theory of ferromagnetism and anti magnetism
		CO 4	Elaborate about the different types of electric polarizations and to classify and compare about the ionic, orientation and space charge polarization
		CO 5	Classify and about types of bonds in crystals. To illustrat about Vanderwaal's and hydrogen bonding. Comparison of ionic and covalent solids .
		CO 6	Elaborate about cohesive energy of ionic solids and the application towards Sodium chloride crystal and the evaluation of Madelung Constant for sodium chloride can be done.
		CO 7	Interpret the general properties of Super conductors. Elaborate the effect of magnetic field and Meissner effect, current of effect.
		CO 8	Illustrate about entrophy. To list out the application of super conductors
		CO 9	Describe about the nano particles and synthesis and its classification. Explain the techniques used in synthesis of nanomaterials and about chemical vapour deposition techniques.
		CO 10	Classify and compare the properties of nano materials. Applications of nano materials can also be explained.

25	a. Energy Physics	CO 1	Understand the importance of conventional and nonconventional energy resources.
		CO 2	Understand the applications, merits, and demerits of conventional and non-conventional energy resources.
		CO 3	Understand the basic aspects of solar energy.
		CO 4	Understand solar energy appliances with their merits and demerits.
		CO 5	Understand the basic aspects of the photovoltaic principle.
		CO 6	Learn about photovoltaic appliances and how they work.
		CO 7	Understand the solar cell with its applications and its types
		CO 8	Understand the basic ideas of biomass energy and recognise their merits and demerits.
		CO 9	Understand the methods and classifications of biomass energy.
		CO 10	Understand the basic principles of wind energy conversion.
		CO 11	Understand the fundamental concepts of oceans and chemical energy resources, as well as their benefits and drawbacks.
26	MEDICAL PHYSICS	CO 1	Define electromagnetic spectrum Sketch the X- ray tube design
		CO 2	Categorize half wave & full wave rectification
		CO 3	Identify the sources of radio activity. Explain the units of radiation
		CO 4	Measure the biological damage
		CO 5	Discuss about CAT scanners, Identify transducers for biomedical applications
		CO 6	Estimate the computer analysis of ECG
		CO 7	State radiography, Compare Ultrasound imaging & magnetic resonance imaging
		CO 8	Determine the uses of Gamma Camera
		CO 9	Generalize the uses of lasers. Interpret the effect of laser radiation on tissues
		CO 10	Justify laser as a beauticians tools

27	PROJECT	CO 1	Design, build and assess the working of scientific models individually as well as in groups
		CO 2	Plan research works related to crystal growth
		CO 3	Synthesize Nano materials and compile the characteristics
		CO 4	Assess the output of electronic projects
		CO 5	Interpret the physical phenomena in theoretical projects
		CO 6	Analyse the various properties of atmosphere using available software
		CO 7	Design solar appliances
		CO 8	Calculate the thickness of different hairs using air wedge apparatus

PROGRAMME NAME : ***M.Sc PHYSICS***

PROGRAMME OUTCOMES

PO - 1	Appreciate the nuances of basic sciences to conceive innovative ideas to enrich the existing technology.
PO - 2	Build new perspectives to look at day to day activities from science point of view.
PO - 3	Take part in finding solutions for complex problems by applying appropriate techniques using modern scientific tools.
PO - 4	Understand the impact of science in matters pertaining to sociology, economics and environmental issues for sustainable development.
PO - 5	Comprehend the basic and advanced concepts in Science to acquire theoretical knowledge as well as practical skills.
PO - 6	Develop a research oriented learning that cultivates analytical and integrative critical thinking skills.
PO - 7	Improve sustainable learning at the individual and group level by visiting industries and R & D organizations.

SL. NO.	COURSE NAME	COURSE OUTCOME	
1	CLASSICAL MECHANICS	CO1	Understand and apply the Lagrangian formalism to simple dynamical systems
		CO2	Study about motion in a central force field in a Lagrangian formalism, classification of orbits, two body collisions and non-inertial frames
		CO3	Apply Hamilton's equations and solve dynamical systems. Apply the properties of Lagrange and Poisson's bracket and canonical transformations for solving simple systems
		CO4	Analyze the motion of rigid bodies using the theory of Rigid body dynamics
		CO5	Understand the basic concepts of general and special theory of relativity
2	MATHEMATICAL PHYSICS – I	CO1	Comprehend the concepts of vector spaces, learn about Gradient, Divergence and Curl in orthogonal curvilinear and explain the physical applications of line, surface and volume integral

		CO2	Derive second order differential equations of various types, their solutions and define Beta and Gamma functions and find its relations
		CO3	Understand the formation and solution of partial differential equations like heat flow equation and wave equation and apply the knowledge to specific physical phenomenon
		CO4	Describe the concept of tensors, contravariant and covariant tensors, metric tensors, Christoffel symbols and applications of tensors to physics
		CO5	Derive probability distributions such as Binomial, Poisson and Gaussian distributions and solve problems in statistics
3	INTEGRATED ELECTRONICS	CO1	Understand the basic concepts of Integrated circuits, its fabrication technology and develop skills to apply it to VLSI Technology
		CO2	Know about of the architecture, functioning, specifications and various applications of standard digital integrated circuits and design various combinational and sequential logic circuits
		CO3	Develop skills to design simple circuits using OPAMP and to solve problems related to it. Gain knowledge to apply it to multiplier circuits and various filter circuits
		CO4	Aware of the architecture, understand functions and applications of IC 555 Timer, IC566, IC 565 PLL
		CO5	Understand the functioning of various electronic circuits and know about Electronic Measurement and Control to Design simple circuits and mini projects
4	NONLINEAR DYNAMICS	CO1	Acquire basic knowledge of nonlinear differential equation and will develop skills of finding solutions to different differential equations and interpreting the solution
		CO2	Capable of finding fixed points and determine the stability of the respective systems and able to understand the different routes to chaos

		CO3	Analyze linear and nonlinear circuits
		CO4	Acquire basic knowledge about fractals and their non-integer dimensions. It gives an insight in to the application of fractals in Hollywood films and communication
		CO5	Gives proper understanding about soliton solutions which are useful in fibre optic communication
5	GENERAL PHYSICS EXPERIMENTS – I	CO1	Strengthen the understanding of interference and diffraction
		CO2	Learn to calibrate electromagnet and determine the magnetic susceptibility of magnetic salts
		CO3	Evaluate basic properties of semiconductor material
		CO4	Learn testing of electrical circuit elements
		CO5	Compare theoretical concepts learned in the class with hands on experiments
6	ELECTRONICS EXPERIMENTS – I	CO1	Measure parameters of basic circuit elements using multimeters and utilize CRO
		CO2	Analyze the working of IC741 and apply it to generate waveforms
		CO3	Differentiate and design analog and digital circuits
		CO4	Construct the circuits independently
7	MATHEMATICAL PHYSICS – II	CO1	Explain special type of matrices, determine its rank and evaluate its eigenvalues and eigenvectors, and perform diagonalization process
		CO2	Understand the basics of algebra with complex variables,identify the singularities of a function and determine the differentiable functions and find its derivatives. Also solve definite integrals using contour integration techniques
		CO3	Derive Bessel and Hermite's differential equations and find their solutions and study their properties
		CO4	Evaluatethe coefficients of Fourier series and deriveFourier, Laplace, Inverse Laplace transforms and alsoillustrate the properties of Fourier and Laplace transforms

		CO5	Describe the concept of group, its types and multiplication tables, prove great orthogonality theorem and construct character tables of a group and also apply group theory to physical situations
8	ELECTROMAGNETIC THEORY	CO1	Have a basic understanding of electrostatics and by applying boundary conditions to solve boundary-value problems in dielectrics
		CO2	Infer magnetic vector potential, bound currents and magnetized materials
		CO3	Apply Maxwell equations in explaining the electromagnetic field due to time varying charge and current distribution
		CO4	Express the idea of electromagnetic wave propagation through reflection, refraction, electromagnetic boundary conditions, wave guides and transmission lines
		CO5	Explain charged particle dynamics and radiation from localized time varying electromagnetic sources
9	MICROPROCESSOR 8085 AND MICROCONTROLLER 8051 Course Outcomes	CO1	Recall the basic concept of microcomputers, Describe the architecture of 8085 with registers, memory in microprocessors, bus cycle, addressing modes
		CO2	Understand assembly language program in 8085 microprocessor using the internal organization, Analyze and Evaluate assembly language programs
		CO3	Understand and Illustrate how the different peripherals are interfaced with Microprocessor and the need for different interfacing devices
		CO4	Compare and analyze the properties of Microprocessors and Microcontrollers. Describe the architecture and functional block of 8051; analyze the data transfer information through serial and parallel ports
		CO5	Understand microcontroller based system design for various applications

10	STATISTICAL MECHANICS	CO1	Acquire the basic ideas about phase space and statistical distributions
		CO2	Gain knowledge on the mathematical concepts in distribution laws, equipartition of energy and entropy relation
		CO3	Understand the transition from classical to quantum statistical mechanics
		CO4	Analyze the theories of specific heat of solids and gas degeneracy
		CO5	Impart the knowledge about phase transitions and the critical exponents
11	: FIELD WORK / STUDY TOUR	CO1	Identify global issues in the local or national community
		CO2	Gather data through interviewing and observation of subjects in the field
		CO3	Act as a useful member or effective leader of a team in multidisciplinary settings
12	: GENERAL PHYSICS EXPERIMENTS – II	CO1	Enhances the understanding of optical phenomena interference and diffraction
		CO2	Apply the above phenomena to study the basic physical properties of materials
		CO3	To learn the thermal behaviour of biased diodes
		CO4	Analyze the given XRD pattern
		CO5	Understand the basic principles involved in optical communication
13	ELECTRONICS EXPERIMENTS – II	CO1	Design amplifier, oscillator and wave shaping circuit for defined specification
		CO2	Explore how to filter signals with resistors and capacitors and exposed to the usage of semi log graph
		CO3	Study the behavior of different types of electronic devices
		CO4	Solve mathematical problems using electronic circuits
14	QUANTUM MECHANICS – I	CO1	Analyze the inadequacy of Classical mechanics to explain black body radiation, photoelectric effect, specific heat of solids and Compton effect and discuss the basic postulates of Quantum mechanics. Also derive Schrodinger wave equation and find its solution

		CO2	Apply Schrodinger wave equation to one and three dimensional problems and develop abstract operator method for harmonic oscillator problem
		CO3	Explain the different types of operators and develop basic ideas of complex abstract space and matrix theory in Quantum Mechanics
		CO4	Derive the fundamental commutation relations, eigen values and eigen states of angular momentum operators, construct angular momentum matrices and discuss the theory of addition of angular momenta
		CO5	Discuss the degenerate and non-degenerate perturbation theory for stationary states and also derive the time independent and dependent perturbation theories and apply it to selected examples of quantum systems
15	ATOMIC AND MOLECULAR SPECTROSCOPY	CO1	Describe theories explaining the spectra of Hydrogen like atoms and ions, magnetic moment, angular momentum and the origin of the observed spectra
		CO2	Identify quantum behaviour of atoms such as normal and anomalous Zeeman, Paschen-Back, Stark and Doppler effects and explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields
		CO3	Understand the rotational and vibrational spectroscopic techniques and apply the same in analyzing the molecular spectra
		CO4	Apply the concepts of electronic and resonance spectroscopic techniques in analyzing its fine structure, magnetic moment of nuclei, dipolar interactions, chemical shift etc
		CO5	Understand the concepts of Raman spectra and apply it to analyze vibrational-rotational Raman spectra of molecules. Also by understanding the concepts of Lasers and apply it to laser resonators
16	CONDENSED MATTER PHYSICS	CO1	Analyze the Crystal structure by applying crystallographic parameters
		CO2	Gain knowledge about vibration of crystals and density of states with some models

		CO3	Understand the concept of energy bands and gaps with theoretical background
		CO4	Acquire knowledge about the available magnetic materials with necessary theories
		CO5	classify condensed matter upon its electrical and transport properties, and understand the superconductivity phenomenon
17	NUMERICAL METHODS AND PROGRAMMING IN C++	CO1	Solve nonlinear equations of higher order which frequently comes in vibration of strings and heat transfer problems
		CO2	Effectively use methods like matrix inversion and Gauss elimination to solve linear equations
		CO3	Apply the skill of curve fitting in obtained spectra like XRD, FTIR, PL and also for base line corrections
		CO4	Model physical systems using first and second order differential equations and solve the equations both analytically and numerically
		CO5	Perform both hand computation and programming
18	ADVANCED PHYSICS EXPERIMENTS – I	CO1	Gain practical knowledge of various measurements
		CO2	Analyze UV spectrum of various molecules
		CO3	Understand the working of phototransistors
		CO4	Differentiate linear and nonlinear circuit elements
19	MICROPROCESSOR EXPERIMENTS	CO1	Write and execute programs for solving simple programs
		CO2	Demonstrate programming proficiency using the various addressing modes and data transfer instructions
		CO3	To familiarize with the programming and interfacing microprocessors
		CO4	Generate waveforms using microprocessors
20	QUANTUM MECHANICS – II	CO1	Analyze the different stationary state approximation methods and apply them to solve the Schrodinger equation for various quantum systems

		CO2	Understand the concept of Scattering theory and evaluate scattering cross-section, scattering amplitude by using Born approximation and partial wave analysis methods
		CO3	Distinguish between bosons and fermions and develop the Pauli's exclusion principle and also explain the theory of identical particles and solvethe dynamics of two electron atom using the idea of identical particles
		CO4	Establish the Schrodinger and Heisenberg formulations of time development and their applications and explain symmetries in Quantum mechanics and also derive Wigner – Eckart theorem
		CO5	Establish the Schrodinger and Heisenberg formulations of time development and their applications and explain symmetries in Quantum mechanics and also derive Wigner – Eckart theorem
21	NUCLEAR AND PARTICLE PHYSICS	CO1	Recall the basic knowledge about of nucleus, also the characteristics of nuclear force. Understand the ground state properties of deuteron behaviour at ground and excited states, Apply deuteron physics and the Nucleon-Nucleon scattering for explaining the nuclear forces
		CO2	Acquire knowledge about nuclear decay processes and their outcomes. Grasp knowledge about Nuclear Fission and their characteristics using selection rules and apply, evaluate it to cluster decay
		CO3	Gain knowledge about various nuclear models and understand the corresponding nuclear potentials and its dependence on the couplings are learned and can be able to calculate and analyze masses of different nuclei
		CO4	Understand, apply and analyze various aspects of nuclear reactions in view of compound nuclear dynamics and the energy released

		CO5	understand the basic forces in nature, classification of particles, conservation laws and quark models and analyze allowed and forbidden reactions.
22	RESEARCH METHODOLOGY	CO1	Analyze the different stationary state approximation methods and apply them to solve the Schrodinger equation for various quantum systems
		CO2	Understand the concept of Scattering theory and evaluate scattering cross-section, scattering amplitude by using Born approximation and partial wave analysis methods
		CO3	Distinguish between bosons and fermions and develop the Pauli's exclusion principle and also explain the theory of identical particles and solvethe dynamics of two electron atom using the idea of identical particles
		CO4	Establish the Schrodinger and Heisenberg formulations of time development and their applications and explain symmetries in Quantum mechanics and also derive Wigner – Eckart theorem
		CO5	Discuss the central concept and principles ofrelativistic quantum mechanicsand explain electromagnetic potentials and derive Dirac equation and Dirac matrices
23	ADVANCED PHYSICS EXPERIMENTS – II	CO1	Evaluate the basic properties of semiconductor, magnetic and dielectric materials
		CO2	Find out the fixed points, draw stability and bifurcation diagram
		CO3	Form diffraction grating inside liquid
		CO4	Analyze and interpret experimental data using graphs
24	C++ PROGRAMMING	CO1	Familiar with algorithm and flowchart
		CO2	Write their own C++ programs, compile and execute

		CO3	Exposed to practical implementation of numerical methods in programming
		CO4	Trained to plot graph using software
25	OPTOELECTRONICS	CO1	Understand fundamental properties of light and wave-propagation thereby applying it to analyze the resonant cavities at plane boundaries
		CO2	Infer the operation principles of different types of integrated waveguides and examine the integrated optical network
		CO3	Associate the concept of optical fibre, its construction and importance in communication physics
		CO4	Analyze different laser systems and its characteristics, design architectures
		CO5	Interpret the process of image formation and reproduction in hologram; Also able to examine different types of holograms
26	MATERIALS SCIENCE	CO1	Understand the applications of phase diagram and the overall transformation kinetics
		CO2	Gains knowledge about the elastic, anelastic and viscoelastic behavior
		CO3	Realize the nature of crystalline solids and also acquires knowledge about the classification of polymers
		CO4	Know the concept of various imperfections exists within the crystal lattice
		CO5	Acquires a good knowledge about the mechanisms of oxidation and corrosion and also the protection methods against fracture
27	NANOPHYSICS	CO1	Understand various chemical and physical methods for the synthesis of diverse types of nano materials (0D, 1D and 2D)
		CO2	Quantify Mechanical properties of solids in terms of stress and strain and their relationship to each other and analyze synthesis methods for various nano composite materials
		CO3	Understand different Nano material Characterization and apply it to study the characterization

		CO4	Able to categorize functional materials in terms of structural, mechanical, thermal, optical and electrical properties
		CO5	Gain knowledge about the various applications of Nano structured materials in biotechnology, electronics, defense and photonic
28	RENEWABLE ENERGY SOURCES	CO1	Describe the different types of energy sources in India and world as well
		CO2	Explain solar cells and biomass conversion
		CO3	Enumerate the theory of geothermal and tidal energy conversion
		CO4	Differentiate thermoelectric and thermionic energy sources
		CO5	Explore the applications of chemical energy sources
29	PROJECT	CO1	Gain more knowledge in the area of the selected project work
		CO2	Apply the various research methods to different similar practical situation
		CO3	Develop the oral, written and visual communication skills
		CO4	Use the research findings for future studies