2220	M. Sc. (Physics)		
Course Code	**Course Title**	**CO NO**	**Description of the Course Outcome**
17PH5101	Mathematical Physics	CO1	Classify the analytical functions, complex integration and evaluation of definite integrals
		CO2	Analyze Beta and Gamma functions and some special functions
		CO3	Describe and Apply the transform technique for functions
		CO4	Apply the numerical technique to solve functions and system of equations
17PH5102	Classical Mechanics	CO1	Explain the applications of Newtonian mechanics and the formulation of Lagrange's equations of motion from D'Alembert principle.
		CO2	Reduction of problem of two body problem to One body problem and Classification of orbits
		CO3	Explain the applications of Hamilton's equations, Canonical transformations, Poisson brackets, Invariance of Poisson bracket under canonical transformations– Principle of least action
		CO4	Illustrate the Hamilton Jacobi equations and characteristic functions, Action and angle variable, small oscillations, applications such as linear tri-atomic molecule, two carts connected with three springs, triple pendulum, and double pendulum.
17PH5103	Quantum Mechanics-I	CO1	Introduction to Quantum Mechanics and its principles
		CO2	Derivation of Scrodinger's wave equation and its application to one dimensional problems
		CO3	Introduce angular momentum and spin concept
		CO4	Applying Schrodinger's wave equation to three dimensional problems and time independent perturbed problems
17PH5104	Electronics	CO1	Analyzing electronic circuits using various Network theorems
		CO2	Understand various semiconductor devices principles and their applications
		CO3	Understand basics of transistor amplifiers through different transistor models and Oscillators
		CO4	Understand basics of operational amplifiers and their various applications

		CO5	Expertise the student in some electronics related experiments using different transistors and op-amps
17PH5105	Modern Physics Lab	CO1	Expertise the student in some modern physics related experiments
17PH5201	Statistical Mechanics	CO1	Explain the microstates and macro states of Ideal gas and microstate and macrostate in classical systems, and derivation of Maxwell's relations, and thermodynamic laws
		CO2	Applications of these ensembles to classical ideal gas and explaining about types of oscillators.
		CO3	Explanation of postulates of Quantum Statistical Mechanics and types of ensembles and energy distributions
		CO4	Explaining of Thermodynamic behavior of Ideal, Bose, Fermi gases and applications of statistical mechanics
17PH5202	Quantum Mechanics - 2	CO1	Applying time dependent perturbation theory to solve different problems
		CO2	Matrix representations of wave function, operator and the solution of harmonic oscillator using matrix mechanism
		CO3	Scattering problems solutions using quantum rules
		CO4	Solutions of central force problems like hydrogen atom using relativistic quantum mechanics
17PH5203	Electromagnetic Theory and Modern Optics	CO1	Explains the wave nature of light in different mediums using Maxwell's equations and Fresnel's equations
		CO2	Explains the properties of Laser, production of Laser, different types of Laser sources and applications
		CO3	Explains the second and third harmonic generations of light and basics of Holography, recording holograms and applications
		CO4	Explains modes of optical fibers, types of fibers, signal degradation in optical fibers and lot of information regarding optical fibers
		CO5	Expertise the student in physics experiments related to light
17PH5204	Solid State Physics-1	CO1	Understands structure of crystalline solids, appreciates structure-property relationship in crystals, crystal diffraction and the concepts of reciprocal lattice
		CO2	Understand the motion of electron in gas and metal and heat capacity of metal
		CO3	Understand the Periodic Zone schemes, Fermi surfaces and different types of orbits and quantization of orbits in a magnetic field
		CO4	Understand the concept of energy bands and effect of the same on electrical properties.
17PH5205	Computational Methods and	CO1	Analyze the C characters, operators, analytic expression, arrays, functions and simple programs

	Programming		Describe and apply the basics of MATLAB to solve linear systems and interpolation
		CO2	Apply MATLAB to solve linear equation, non-linear equation and simultaneous equations
		CO3	Describe and Apply C language and MATLAB to solve interpolations, numerical differentiation and integration
		CO4	Ability to explain pericyclic reactions involved in various organic rearrangement reactions.
17PH5206	Seminar	CO1	explains the topic of any subject on the board using ppt or chalk and talk
17PH53E1	Nuclear and Particle Physics	CO1	Will apply the models describing the basic nucleon and nuclear properties and establish the basic fundamentals necessary for further course outcomes.
		CO2	Properties and decay principles of Beta and Gamma rays will be reviewed, their selection rules will be understood.
		CO3	History of different techniques to detect various kinds of radiation will be learned. Detection and importance of radiation detection using Hyper Pure Germanium Detectors to study various basic science principles and their applications in various fields will be reviewed.
		CO4	Basics of particle physics and their classification will be discussed. Their fundamental properties and functions along with basic particle physics models leading to GUT will be discussed.
17PH53E2	Radar Systems and Satellite communication	CO1	To be learn the Radar operations, types of radar and applications
		CO2	To be learn the signal and data processing for radars, antenna characteristics
		CO3	To be learn the satellite communications, orbital constitutions and Telemetry, Tracking
		CO4	To be learn the coding techniques for INMARSAT VSAT, GPS, RADARSAT, INTELST applications
17PH53E3	Fiber Optic Sensor	CO1	Explains the light properties like total internal reflection and interference
		CO2	Fundamental properties of optical fibers, types of optical fibers and their related information
		CO3	Different concepts of light and information related to interferometers and sensors
		CO4	Explains the fiber optics in modulation sensors and different effects of light
17PH5301	Atomic and Molecular Physics	CO1	Detailed discussion about the electronic structure in atoms using different spectra
		CO2	Study of molecular energy levels using rotational and vibrational spectroscopy

		CO3	Study of Raman effect of rotational, vibrational and polyatomic molecules
		CO4	Detailed discussion about the electronic spectra and resonance spectroscopy like NMR and ESR.
17PH5302	Solid State Physics -2	CO1	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property relationship in crystals.
		CO2	understand the source of a materials magnetic behavior and be able to distinguish types of magnetism and their properties
		CO3	understand semiconductor physics: direct and indirect band-gaps, the effects of doping a semiconductor and Drift and Diffusion – Einstein relation
		CO4	understand the phenomenon of superconductivity: key experiments, some attempts to explain superconductivity, the BCS model
		CO5	Expertise the student in physics experiments related to materials characterization
17PH5303	Digital Electronics and Microprocessors	CO1	Understand numerical and character representations in digital logic, number system, Logic gates, Logical expressions and Boolean algebra.
		CO2	Combinational and sequential systems design using standard gates and filp-flops and minimization methods
		CO3	Understanding logic gates, combinational and sequential Logic Functions.
		CO4	Able to understand and analyze the architectural features of Intel 8085 Microprocessor
		CO5	Applying Microprocessor 8085 programming to solve the mathematical problems and ability to design circuits by digital electronics
17PH5304	Term paper	CO1	Collecting literature from any interested topic related to dissertation of IV semester
17PH54E1	Nano science and Technology	CO1	Understand the basics of nanomaterials, parameters which get effected by scaling down the size of the material, Major approaches and synthesis procedure
		CO2	Explain the basics of principles associated with characterization techniques and usage of the techniques
		CO3	Identifying the change in properties of the nanomaterial in case of metals, semiconductors, insulators, ceramics and polymers and make use of nanomaterials in those devices
		CO4	Understand synthesis of carbon nanotubes and explore their applications.

17PH54E2	Antenna theory and Radio wave Propagation	CO1	To be learn the antenna characteristics, radiation and applications
		CO2	To be learn antenna arrays, advantages; impedance measurements
		CO3	To be learn types of antennas, excitation techniques for designing the antennas
		CO4	To be learn ground wave space wave and sky wave propagation for wireless communications
17PH54E3	Climate change	CO1	energy balance of the earth-atmosphere and inter-glacial and insterstadial events
		CO2	Anthropogenic climate change and Greenhouse gases (GHG) and global warming
		CO3	Future Emissions and Energy Resources and Biological sources of Nitrous oxide, societal resilience.
		CO4	Teleconnections of the world climate system, Climate in relation to sunspot and cosmic activity. Climate phenomena and their relevance for future regional climate change.
17PH54E4	Thin Film Technology	CO1	Explain the concept of thin film technology and the preparation and techniques
		CO2	Explaining the growth and techniques and kinetics
		CO3	Explaining about XRD, TEM and other techniques for Thin film characterization
		CO4	Explaining the various properties of thin films.
17PH54E5	Instrumentation & Measurement Techniques	CO1	Various basic fundamentals of measurements along with techniques to measure them will be taught.
		CO2	Passive Electric Transducers will be introduced and various kinds of them used for various measurements will be briefed.
		CO3	Active Electric Transducers will be introduced and various kinds of them used for various measurements will be reviewed.
		CO4	An important feature to measure the accuracy of any measurement is its error. Errors will be described; ways and means to measure them in various measurement techniques will be learnt. Different ways to reduce errors will also be introduced using graphical methods.
17PH54E6	Glass Science and Technology	CO1	Interpret free ion d2 and f2 configurations; Spin-orbit coupling; Ground states for fn configurations; Coulomb and spin-orbit energies; Intermediate coupling.
		CO2	Explain basic Absorption characteristics of Rare Earth ions

		CO3	Explain the basic formulae related to the luminescence characteristics of Rare earth ions.
		CO4	To understand energy transfer between the different rare earth ions.
17PH54E7	Micro-Electro-Mechanical Systems	CO1	Understand the basic concepts of MEMS technology and relates to the scaling laws that are used extensively in the conceptual design of devices and systems. Also explains the materials and microfabrication processes used for common microcomponents and devices.
		CO2	Understanding the concepts of bulk manufacturing process
		CO3	Understanding the concepts of surface manufacturing process
		CO4	Study and analyze the various microstero methods in the manufacturing of MEMS Devices. And explains the use of CAD and finite elements method in selected case studies and examples in the design and applications of MEMS devices.
17PH54E8	Weather Hazards & Risk Assessment	CO1	Types of weather hazards
		CO2	Hydrological Modeling - water quality modeling.
		CO3	Disaster Impact and Damage Analysis
		CO4	Pre-Disaster Risk Assessment and Risk Information for Risk Reduction Planning
17PH5401	Dissertation	CO1	Gives overall information about the selected topic theoretically and experimentally