Government City College (A)
Nayapul, Hyderabad
Affiliated to Osmania University
Accredited with 2.76 B^{++} Grade

Department of Physics

MSc Physics - Course Outcomes

Semester I
Paper 1: Mathematical Physics

CO1	**Remember:** Recall the significance and fundamental concepts of Legendre's and Bessel's Differential Equations in the context of physics.
CO2	**Understand:** Grasp the importance and applications of Hermite and Laguerre Differential Equations in various physical phenomena.
CO3	**Apply:** Apply knowledge of Fourier and Laplace transforms to practical physics problems, demonstrating an understanding of their applications.
CO4	**Analyze:** Demonstrate the ability to solve complex problems involving matrices, comprehend tensors, and utilize C programming to analyze physical systems.
CO5	**Create:** Integrate mathematical tools to solve numerical physics problems and utilize these methods to further academic research and advanced studies in physics.

Paper 2: Classical mechanics

CO1	**Apply:** Able to apply classical mechanics and modified equations to understand conservation theorems and explore the framework of Minkowski space.
CO2	**Understand:** Understand the concept of D'Alembert's principle and Hamilton's principle in the realm of physics.
CO3	**Analyze:** Acquire and analyze knowledge of the Principle of Least Action and effectively apply Hamilton's equations.
CO4	**Analyze:** Grasp and dissect the concepts of Lagrangian formulation for continuous systems and Hamiltonian formulation.
CO5	**Create:** Cultivate the skill to differentiate between quantum mechanics and classical mechanics and creatively apply this knowledge to various physical scenarios.

Paper 3: Quantum Mechanics

CO1	**Remember**: Recognize the significance of quantum mechanics over classical mechanics, acknowledging its impact in modern physics.
CO2	**Apply:** Apply the axioms of quantum mechanics, utilize operators and wave functions, and solve the Schrödinger equation to determine Eigenvalues for simple systems like the harmonic oscillator and hydrogen-like atoms.
CO3	**Understand**: Comprehend the basic commutation relations in quantum mechanics, particularly for angular momentum operators, and understand their implications.
CO4	**Analyze:** Analyze and differentiate between concepts such as scattering cross-section, total scattering cross-section, and scattering amplitude in quantum mechanics.
CO5	**Create**: Integrate and employ concepts from modern and nuclear physics to innovate and solve complex problems in various branches of science.

Paper 4: Electronics

CO1	**Understand:** Gain an understanding of the operational principles of amplifiers and oscillators in electronic circuits.
CO2	**Remember:** Recall the foundational knowledge of operational amplifiers, as well as analog-to-digital (A-D) and digital-to-analog (D-A) converters.
CO3	**Apply:** Apply the concepts of Boolean algebra and Karnaugh maps (K-map) to simplify logic expressions, and utilize this understanding to work with logic gates and counters.
CO4	**Understand:** Comprehend the basic functions and programming of microprocessors.
CO5	**Create:** Use the acquired knowledge creatively to troubleshoot and solve practical problems in printed circuit boards (PCBs) and electronic appliances

Semester II

Paper 1: Electromagnetic Theory

CO1	**Remember:** Recall the significance and foundational principles of Maxwell's Equations in the context of electromagnetic theory.
CO2	**Understand:** Understand the propagation of electromagnetic (EM) waves in various media and comprehend how different conditions affect wave behavior.
CO3	**Apply:** Apply basic theories of the interaction between electromagnetic waves and matter to predict and explain outcomes in practical scenarios.
CO4	**Analyze:** Analyze different electromagnetic fields and radiating systems to understand their design and functioning.
C05	**Create:** Use the knowledge of wave propagation in different media to innovate and develop applications like antennas, RADAR systems, and other advanced communication devices.

Paper 2: Statistical Mechanics

CO1	**Remember:** Recall the fundamental concepts of entropy, statistical ensembles, and Liouville's theorem.
CO2	**Understand:** Understand the principles and applications of Bose-Einstein, Maxwell-Boltzmann, and Fermi-Dirac statistics.
CO3	**Apply:** Apply the concept of Bose-Einstein condensation and explore the phenomenon of superfluidity in Helium II.
CO4	**Analyze:** Analyze theoretical models such as the Bragg-Williams approximation and the Ising model to understand phase transitions and critical phenomena.
CO5	**Create:** Integrate and creatively apply statistical mechanics concepts to solve problems at both the micro and macroscopic levels in various scientific and engineering contexts.

Paper 3: Quantum Mechanics- II

CO1	**Apply:** Apply both the time-dependent and time-independent Schrödinger equation to various potentials, demonstrating an understanding of their implications in quantum systems.
CO2	**Analyze:** Analyze quantum systems using approximate methods such as the variational method, perturbation theory, and the Born approximation to find solutions to the Schrödinger equation.
CO3	**Remember:** Recall the fundamentals of spin, angular momentum states, angular momentum addition rules, and the behavior of identical particles in quantum mechanics.
CO4	**Understand:** Understand the application of quantum mechanics principles in advanced theoretical studies and nanotechnology.
CO5	**Create:** Create new materials and explore their functions within the electromagnetic spectrum using the principles of quantum mechanics.

Paper 4: Solid State Physics

CO1	**Remember:** Recall the significance of different crystal structures in materials science.
CO2	**Understand:** Grasp the concepts of 1D and 2D lattice vibrations, the various theoretical approaches to them, and their role in determining the thermal properties of solids.
CO3	**Apply:** Apply the basic theories of solids to distinguish between metals, semiconductors, insulators, and comprehend the Fermi theory.
CO4	**Analyze:** Analyze the methods of crystal growth techniques and identify the different types of defects that can occur in solids.
CO5	**Create:** Synthesize new materials using the knowledge gained from the study of materials and nanoscience, targeting specific applications.

Semester III

Paper 301- Modern Optics

CO1	**Remember:** Recall the significance of lasers across various fields such as industrial, medical, and cosmetic applications, understanding their impact and versatility.
CO2	**Understand:** Grasp the different types of laser systems, their operational principles, and their respective uses in technology and research.
CO3	**Apply:** Apply the fundamental theories of holography to understand and create different types of holograms for various applications.
CO4	**Analyze:** Analyze the principles of Fourier optics and nonlinear optics to understand their implications in the advancement of optical technologies.
CO5	**Create:** Utilize knowledge of optics to innovate in the field of light generation, including the use of lenses and parametric light generation techniques, for advancing optical applications.

Paper 302: Advanced Solid-State Physics

CO1	**Understand:** Gain an understanding of the basic mechanical properties of materials, including elasticity, plasticity, toughness, and hardness.
CO2	**Apply:** Apply knowledge to interpret stress vs. strain curves, extracting key mechanical properties such as the tensile modulus, yield strength, and ultimate tensile strength.
CO3	**Understand:** Comprehend the role of grain boundaries in the deformation of materials and how microstructural features influence material properties.
CO4	**Analyze:** Analyze various material characteristics, understanding their significance and application in the materials industry, including selection criteria for different engineering applications.
CO5	**Apply:** Apply techniques to identify different types of materials and understand the mechanisms of corrosion, including preventive measures and material selection to mitigate corrosion effects.

Paper 303: Electronic Instrumentation

CO1	**Remember:** Recall the different types of errors and the characterization of systems based on their order, understanding the basics of system analysis.
CO2	**Apply:** Apply knowledge in the fabrication of amplifiers and filters, learning the practical aspects of designing and building these components.
CO3	**Apply:** Utilize amplifiers and filters in electric circuits, demonstrating their application in enhancing or modifying signals according to specific requirements.
CO4	**Understand:** Grasp the concept of various types of signal generators and analyze the factors that affect signal quality and integrity.
CO5	**Create:** Engage in the construction of digital displays and recording systems, understanding their characteristics and the technology behind their operation.

Paper 304: Embedded Systems and its Applications

CO1	**Understand:** Gain a comprehensive understanding of the 8051 microprocessor's block diagram, including its architecture and how its components interact.
CO2	**Apply:** Apply knowledge of logical instructions and programming techniques to perform operations such as logic, comparison, rotation, and swapping.
CO3	**Understand:** Comprehend the functionalities of microcontrollers, including their timers, and the process of analog to digital conversion, emphasizing how these components interact within a microcontroller system.
CO4	**Analyze:** Analyze the applications of microprocessors and microcontrollers across various fields, understanding their role in the design and implementation of electronic systems.
CO5	**Understand:** Gain insight into the operation of counters, registers, and memory devices, understanding how these components are integrated and utilized in microprocessor and microcontroller systems.

Semester IV

CO1	**Remember:** Recall the fundamental concepts of various nuclear models and the principles of nuclear force that explain the structure and behavior of nuclei.
CO2	**Understand:** Understand the processes and underlying theories of α-decay, including Gamow's theory, and β-decay, based on Fermi's theory, and their implications in nuclear physics.
CO3	**Apply:** Apply knowledge of the Compton Effect, as well as the operation and application of scintillation and solid-state detectors in the measurement and analysis of nuclear phenomena.
CO4	**Analyze:** Analyze the principles and outcomes of nuclear reactions and delve into the basic concepts of particle physics, understanding the forces and particles that constitute the nucleus.
CO5	**Understand:** Grasp the significance of nuclear energy, including its generation, applications, and impact on society, with an emphasis on its role in power generation and medical applications.

Paper 402: Spectroscopy

CO1	**Remember:** Recall the significance of atomic and alkali spectra in understanding the fundamental properties of elements and their electronic configurations.
CO2	**Understand:** Grasp the different types of molecular spectra and the mechanisms by which they are produced, including electronic, vibrational, and rotational transitions.
CO3	**Apply:** Apply basic principles of Raman and Infrared (IR) Spectroscopy to analyze molecular structures and dynamics.
CO4	**Analyze:** Analyze the principles and applications of Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) spectroscopy in detailed molecular and electronic structure determination.
CO5	**Create:** Utilize the knowledge of molecular, Raman, ESR, and NMR

	spectroscopies creatively to solve complex problems in chemistry, biology, and materials science, enhancing the understanding of molecular and atomic structures and their interactions.

Paper 403: Instrumentation for measurement and Data transmission

CO1	**Understand:** Gain an understanding of the operational principles and applications of various transducers for strain and pressure measurements.
CO2	**Understand:** Comprehend the methodologies and technologies used in measuring pressure, temperature, and flow in different systems.
CO3	**Apply:** Apply concepts of process control, including the use of transfer functions, to manage and optimize different systems effectively.
CO4	**Understand:** Grasp the fundamentals of analog and digital data acquisition systems, including their design and operational nuances.
CO5	**Apply:** Utilize knowledge of flow measurement techniques, telemetry, and multiplexing in practical applications to enhance data transmission and monitoring in various engineering contexts.