PROGRAMME OUTCOMES (PO):

At the end of the graduate programme, a student would:

PO1	**Knowledge Acquisition:** Demonstrate a profound understanding of knowledge trends and their impact on the chosen discipline of study.
PO2	**Communication, Collaboration, Inclusiveness, and Leadership:** Become a team player who drives positive change through effective communication, collaborative acumen, transformative leadership, and a dedication to inclusivity.
PO3	**Professional Skills:** Demonstrate professional skills to navigate diverse career paths with confidence and adaptability.
PO4	**Digital Intelligence:** Demonstrate proficiency in varied digital and technological tools to understand and interact with the digital world, thus effectively processing complex information.
PO5	**Scientific Awareness and Critical Thinking:** Emerge as an innovative problem-solver and impactful mediator, applying scientific understanding and critical thinking to address challenges and advance sustainable solutions.
PO6	**Human Values, Professional Ethics, and Societal and Environmental Responsibility:** Become a responsible leader, characterized by an unwavering commitment to human values, ethical conduct, and a fervent dedication to the well-being of society and the environment.
PO7	**Research, Innovation, and Entrepreneurship:** Emerge as a researcher and entrepreneurial leader, forging collaborative partnerships with industry, academia, and communities to contribute enduring solutions for local, regional, and global development.

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the BSc Physics Honours programme, a student would:

PSO1	Understand concepts and applications in the field of Physics viz. Mechanics, Electrodynamics, Thermodynamics, Optics, Quantum Mechanics, Electronics etc.
PSO2	Develop the skills for experimentation to measure, analyse and interpret empirical data, and present the results in a methodical and accessible way.
PSO3	Evaluate complex real-world problems by applying principles of theoretical and applied physics, and mathematical and computational models.
PSO4	Design and execute a Project to solve real-world problems in accordance to the need of the industry and academic research, in a stipulated time frame.
PSO5	Develop understanding of the fundamental concepts of Physics needed for a deeper study of related fields of knowledge viz. Mathematics, Chemistry, Electronics, Computer Science, Geology etc.
PSO6	Develop the experimental and analytical skills in Physics that can be of useful applications in allied areas of knowledge.

BSc PHYSICS HONOURS
MAJOR CORE COURSES

Programme	**B.Sc. Physics Honours**				
Course Title	**FUNDAMENTALS OF PHYSICS**				
Type of Course	**Core in Major**				
Semester	**I**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Fundamentals of vectors, calculus and kinematics.				
Course Summary	This course explores Newton's Laws of Motion and how they can be applied to solve different mechanical systems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concepts of Newton's Laws of Motion	U	C	Instructor-created exams / Quiz
CO2	Apply Newton's Laws of Motion to solve different mechanical systems	Ap	P	Instructor-created exams / Home Assignments
CO3	Apply work-energy theorem to solve different mechanical systems	Ap	P	Instructor-created exams / Home Assignments
CO4	Analyse conservative systems and solve them using the conservation of mechanical energy.	An	P	Instructor-created exams / Home Assignments
CO5	Demonstrate critical thinking and problem-solving skills by applying the concepts and	Ap	P	Seminar Presentation / Group Tutorial Work

	techniques learned to solve an extended set of real-world problems.			
CO6	Demonstrate skills to set up and perform experiments to test Newton's Laws of Motion and related concepts.	Ap	P	Practical Assignment / Observation of Practical Skills / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

IMPORTANT: This course is for the Double Major pathway only. It should not be offered for the other four pathways.

Programme	**B. Sc. PhysicsHonours**				
Course Title	**ELEMENTS OF MODERN PHYSICS**				
Type of Course	**Core in Major**				
Semester	**I or II (depending upon the batch in the Double Major)**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Higher secondary Physics				
Course Summary	The course integrates key principles of modern physics, including the Special Theory of Relativity, wave-particle duality, and the Bohr Atom Model, to provide students with a comprehensive understanding of fundamental concepts and their applications in diverse scientific fields.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of the Special Theory of Relativity	U	C	Written exams, quizzes
CO2	Explain the dual nature of particles and waves	U	C	Problem sets, essays
CO3	Apply relativistic principles to solve problems	Ap	P	Problem-solving exams, simulations
CO4	Analyse experimental evidence supporting wave-particle duality	An	C	Laboratory reports, case studies

CO5	Compare and contrast classical and quantum mechanical models	An	C	Research papers, presentations
CO6	Critically evaluate the limitations of the Bohr atom model	E	C	Research projects, discussions

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRONICS I**				
Type of Course	**Core in Major**				
Semester	**II**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	The course usually encompasses proficiency in mathematics, physics, and basic circuit theory, alongside computer literacy and potentially some laboratory experience, ensuring students have the foundational knowledge needed for the course material.				
Course Summary	The course provides students with a comprehensive introduction to fundamental concepts in electronics, including circuit analysis, semiconductor devices and digital logic, equipping them with the essential skills and knowledge needed to understand and work with electronic systems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define the basic concepts of semiconductor physics, including energy bands, charge carriers, and doping.	R	F	Quizzes

CO2	Explain the operating principles of semiconductor diodes, including forward and reverse bias conditions.	U	C	Problem sets, concept maps
CO3	Analyse the applications of semiconductor diodes in rectification, clipping, and clamping circuits.	An	C	Research papers, case studies
CO4	Explain the principles of operation of bipolar junction transistors (BJTs) and field-effect transistors (FETs), including their modes of operation and characteristics.	U	C	Problem sets, concept maps
CO5	Apply transistor models to analyse amplifier circuits.	Ap	P	Laboratory experiments, simulations
CO6	Define the basic concepts of digital electronics, including binary number systems, hexadecimal number systems	R	C	Quizzes
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**MECHANICS -I**				
Type of Course	**Core in Major**				
Semester	**III**				
Academic Level	**200-299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY1CJ101: Fundamentals of Physics				
Course Summary	This course explores Newton's Laws of Motion and how they can be applied to solve different mechanical systems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Understand the concepts of linear and angular momentum, and dynamics of linear and rotational motion	U	C	Instructor-created exams / Quiz
CO2	Understand the concepts of the conservation laws of linear and angular momentum	U	C	Instructor-created exams / Quiz
CO3	Analyse collisions of particles using the conservation of linear momentum	An	P	Instructor-created exams / Home Assignments
CO4	Analyse rotating systems using the conservation of angular momentum	An	P	Instructor-created exams / Home Assignments
CO5	Demonstrate critical thinking and problem-solving skills by applying the concepts and techniques learned to solve an extended set of real-world problems.	Ap	P	Seminar Presentation / Group Tutorial Work
CO6	Demonstrate computational skills to solve an extended set of computational projects based on real-world problems	Ap	P	Seminar Presentation / Group Tutorial Work / Group Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**COMPUTATIONAL PHYSICS**				
Type of Course	**Core in Major**				
Semester	**III**				
Academic Level	**200-299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic computer knowledge.				
Course Summary	This course aims to equip students with computational and simulation methods in physics using Python programming. Numerical methods for				

	differentiation, integration, solving differential equations, interpolation and curve fitting are introduced.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand computational thinking by learning Logical and algorithmic thinking.	U	F	Instructor-created exams.
CO2	Understand python syntax and write basic python programs using loops, several data types etc	Ap	P	Instructor-created exams / Practical Assignment
CO3	Understand Numpy and matplotlib modules and apply them to matrix manipulation and graphing data.	Ap	P	Instructor-created exams / Practical Assignment
CO4	Understand the significance of computational methods in physics.	U	F	Instructor-created exams / Seminar Presentation
CO5	Understanding the concepts of interpolation, curve fitting, numerical differentiation, integration and ODEs in physics using python	Ap	P	Instructor-created exams / Practical Assignment
CO6	Applying the computational and simulation methods to several branches of physics using python.	Ap	P	Instructor-created exams / Practical Assignment

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRODYNAMICS I**				
Type of Course	**Core in Major**				
Semester	**IV**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	A strong foundation in mathematics, including algebra, trigonometry, and calculus. Additionally, a basic understanding of physics concepts such as				

	electricity, magnetism, and mechanics would be beneficial for grasping the principles covered in the course.
Course Summary	The course provides a foundational exploration of electromagnetism, encompassing topics like electric fields, magnetic fields and electromagnetic induction. Through simplified explanations, illustrative examples, and conceptual exercises, students gain insight into the behavior and interactions of electric and magnetic fields, preparing them for more advanced studies in physics or related fields at the undergraduate level.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply vector analysis techniques to solve problems in electromagnetics	Ap	C	Problem-solving assignments, quizzes
CO2	Analyze and calculate electric fields and potentials for various charge distributions	An	P	Homework assignments, exams, simulation exercises
CO3	Investigate the behavior of magnetic fields and solve problems involving magnetostatics	E	C	Laboratory reports, group projects, exams
CO4	Utilize electrical measurement instruments to quantify electric and magnetic phenomena	Ap	P	Laboratory experiments, instrument operation tests, practical assessments
CO5	Demonstrate an understanding of Maxwell's equations and their implications in electromagnetism	U	C	Concept maps, oral presentations, written exams
CO6	Apply theoretical knowledge to analyze and design simple electromagnetic systems	C	P	Design projects, case studies, final projects

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**

Course Title	**MECHANICS -II**				
Type of Course	**Core in Major**				
Semester	**IV**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY3CJ201: Mechanics -I				
Course Summary	This course explores Newton's Laws of Motion and how they can be applied to solve different mechanical systems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concepts of Newton's Laws of Motion	U	C	Instructor-created exams / Quiz
CO2	Apply Newton's Laws of Motion to solve different mechanical systems	Ap	P	Instructor-created exams / Home Assignments
CO3	Apply work-energy theorem to solve different mechanical systems	Ap	P	Instructor-created exams / Home Assignments
CO4	Analyse conservative systems and solve them using the conservation of mechanical energy.	An	P	Instructor-created exams / Home Assignments
CO5	Demonstrate critical thinking and problem-solving skills by applying the concepts and techniques learned to solve an extended set of real-world problems.	Ap	P	Seminar Presentation / Group Tutorial Work
CO6	Demonstrate skills to set up and perform experiments to test Newton's Laws of Motion and related concepts.	Ap	P	Practical Assignment / Observation of Practical Skills / Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**

Course Title	**MODERN PHYSICS**				
Type of Course	**Core in Major**				
Semester	**IV**				
Academic Level	**200 -- 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Foundation in classical mechanics and electromagnetism. Additionally, students should have a solid understanding of calculus and differential equations to effectively engage with the mathematical concepts presented in the course.				
Course Summary	The course integrates key principles of modern physics, including the Special Theory of Relativity, wave-particle duality, and the Bohr Atom Model, to provide students with a comprehensive understanding of fundamental concepts and their applications in diverse scientific fields. Through theoretical discussions and experimental investigations, students develop critical thinking skills and the ability to analyse complex physical phenomena at both macroscopic and microscopic levels.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of the Special Theory of Relativity	U	C	Written exams, quizzes
CO2	Explain the dual nature of particles and waves	U	C	Problem sets, essays
CO3	Apply relativistic principles to solve problems	Ap	P	Problem-solving exams, simulations
CO4	Analyse experimental evidence supporting wave-particle duality	An	C	Laboratory reports, case studies
CO5	Compare and contrast classical and quantum mechanical models	An	C	Research papers, presentations
CO6	Critically evaluate the limitations of the Bohr atom model	E	C	Research projects, discussions

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRODYNAMICS II**				
Type of Course	**Core in Major**				
Semester	**V**				
Academic Level	**300-399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY4CJ203- Electrodynamics I				
Course Summary	The course emphasizes the development of mathematical techniques such as vector calculus and differential equations to solve complex problems in electromagnetism. Through theoretical discussions, problem-solving sections, and possibly laboratory experiments, students gain a deep understanding of electromagnetic phenomena and their applications in various fields such as optics, electronics, and telecommunications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the fundamental principles of electromagnetism and Maxwell's equations	U	C	Written exams, quizzes
CO2	Apply mathematical techniques such as vector calculus and differential equations to solve electromagnetic problems	Ap	P	Problem sets, simulations
CO3	Analyze the behavior of electromagnetic fields in various media and under different boundary conditions	An	C	Homework assignments, exams
CO4	Derive and interpret the electromagnetic wave equation and its solutions	U	C	Class discussions, presentations
CO5	Predict and analyze the behavior of electromagnetic waves in different contexts, such as optics and antenna theory	Ap	P	Laboratory experiments, projects
CO6	Design and analyze complex electromagnetic systems and	C	P	Research papers, presentations

	devices using advanced electrodynamics principles			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**OPTICS**				
Type of Course	**Core in Major**				
Semester	**V**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Fundamental understanding of basic physics principles, including optics, electromagnetic waves, and mathematical concepts such as calculus and trigonometry.				
Course Summary	The course offers an in-depth study of light phenomena, covering polarization effects, diffraction phenomena, and their applications in optical systems and technologies.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define the basic principles of optics.	R	C	Quizzes
CO2	Analyse optical phenomena using Fermat's Principle, such as reflection and refraction.	An	C	Research papers, case studies
CO3	Apply the principles of optics to design optical systems.	Ap	P	Laboratory experiments, projects
CO4	Analyse optical phenomena interference	An	P	Research papers, case studies
CO5	Apply diffraction principles to analyze patterns	Ap	P	Laboratory experiments, simulations

	produced by various apertures and obstacles.			
CO6	Apply polarization concepts to analyze optical phenomena.	Ap	P	Laboratory experiments, simulations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**QUANTUM MECHANICS I**				
Type of Course	**Core in Major**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Fundamental Mathematics Concepts: Vector, Matrix, 2nd Order ODE, Probability.				
Course Summary	This comprehensive course aims to provide students with a solid foundation in quantum mechanics, delving into theoretical concepts, honing problem-solving skills, and offering exciting possibilities through hands-on simulations.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate a deep understanding of the foundational principles of quantum mechanics	U	C	Written exams, quizzes
CO2	Solve complex quantum mechanical problems using mathematical formalism such as the Schrödinger equation	Ap	P	Problem sets, simulations
CO3	Analyze the quantum behavior of systems with discrete and continuous spectra	An	C	Homework assignments, exams

CO4	Explain the physical significance of quantum mechanical operators and their properties	U	C	Class discussions, presentations
CO5	Predict the outcomes of quantum experiments and interpret their results within the framework of quantum theory	E	C	Virtual lab experiments, projects
CO6	Apply quantum mechanics principles to understand topics such as box problem and quantum harmonic oscillator	Ap	P	Research papers, presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**THERMODYNAMICS**				
Type of Course	**Core in Major**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Proficiency in calculus, basic physics principles including mechanics and heat transfer, and a foundational understanding of chemistry are typically prerequisites for an undergraduate thermodynamics course.				
Course Summary	Thermodynamics course covers fundamental principles such as the conservation of energy, entropy, and thermodynamic properties of substances, providing students with the knowledge to analyse and predict the behaviour of systems in various contexts, from power generation to environmental processes				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate a solid understanding of the fundamental principles of thermodynamics, including the laws	U	C	Conceptual quizzes,

	of thermodynamics and their mathematical representations.			written examinations
CO2	Apply thermodynamic concepts to analyze and solve problems in classical physics.	Ap	P	Problem-solving exercises, laboratory experiments
CO3	Utilize mathematical tools, including calculus and differential equations, to model thermodynamic systems and predict their behavior.	Ap	P	Mathematical problem sets, computational assignments
CO4	Interpret thermodynamic properties of materials and their phase transitions, connecting theoretical concepts with experimental observations.	An	M	Data analysis projects, laboratory reports
CO5	Evaluate and compare the efficiency and performance of thermodynamic processes and cycles, including practical applications such as heat engines and refrigeration systems.	E	M	Performance assessments, design projects
CO6	Apply thermodynamics principles to interdisciplinary areas such as materials science, environmental science, and astrophysics, demonstrating the relevance and versatility of thermodynamic concepts.	Ap	P	Research projects, case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRONICS II**				
Type of Course	**Core in Major**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY2CJ101- Electronics I				

Course Summary	Course provides students with a comprehensive understanding of transistor operation, FET characteristics, and Op-Amp applications, preparing them for designing and analyzing electronic circuits.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental principles of analog and digital electronics.	U	C	Quizzes, Tests
CO2	Analyse different types of amplifiers and their applications.	An	P	Homework Assignments
CO3	Design amplifier circuits based on given specifications.	Ap	P	Laboratory Experiments
CO4	Analyse the operation of different types of FETs (JFETs, MOSFETs).	An	P	Homework Assignments
CO5	Understand the operational principles of Operational Amplifiers (Op-amps).	U	C	Quizzes, Assignments
CO6	Analyse and design sequential logic circuits using state diagrams and flip-flops.	An	P	Laboratory Experiments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**NUCLEAR AND PARTICLE PHYSICS**				
Type of Course	**Core in Major**				
Semester	**VI**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60

Pre-requisites	Strong foundation in classical mechanics, electromagnetism, quantum mechanics, and mathematics along with a basic understanding of modern physics concepts.
Course Summary	The course in nuclear and particle physics provides an in-depth exploration of the fundamental constituents of matter, their interactions, and the underlying principles governing nuclear structure, particle behavior, and their implications in theoretical and experimental physics.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental principles of nuclear and particle physics.	U	C	Quizzes, Tests
CO2	Analyse nuclear structure and properties, including nuclear forces and decay processes.	An	P	Homework Assignments
CO3	Apply theoretical models to predict nuclear reactions and particle behavior.	Ap	C	Problem Sets, Projects
CO4	Analyse the processes and mechanisms of radioactive decay.	An	P	Homework, Exams
CO5	Describe the operation and components of particle accelerators.	U	F	Virtual lab Demonstrations
CO6	Analyse the principles and techniques of particle Detectors.	An	C	Problem Sets, Exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**MATHEMATICAL PHYSICS**				
Type of Course	**Core in Major**				
Semester	**VII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours

	4	3	-	2	75
Pre-requisites	Fundamentals of vectors, calculus and kinematics.				
Course Summary	This course explores Newton's Laws of Motion and how they can be applied to solve different mechanical systems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate proficiency in manipulating matrices and tensors algebraically and geometrically	Ap	P	Written exams, problem sets
CO2	Apply various transforms such as Fourier, Laplace, and Z-transforms to analyze signals and systems	Ap	P	Homework assignments, exams
CO3	Understand the properties and applications of special functions such as Bessel, Legendre, and Hermite functions	U	C	Class discussions, presentations
CO4	Solve differential equations using series solutions methods, including power series and Frobenius methods	Ap	P	Laboratory experiments, simulations
CO5	Analyze the behavior of complex functions, including their mappings and singularities, in the complex plane	An	C	Projects, research papers
CO6	Utilize complex analysis techniques to solve problems in physics, engineering, and other applied fields	Ap	P	Design projects, presentations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**
Course Title	**CLASSICAL MECHANICS**

Type of Course	**Core in Major**				
Semester	**VII**				
Academic Level	**400 – 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Strong foundation in introductory physics covering Kinematics, Dynamics and basic calculus, alongside a familiarity with vectors, Newton's laws of motion, and mathematical techniques such as differential and integral calculus.				
Course Summary	Exploring topics such as Lagrangian and Hamiltonian Mechanics, Variational principles and coupled oscillations, often incorporating advanced mathematical techniques like differential geometry and calculus of variations.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of calculus of variations and its applications in finding extremals of functionals	U	C	Written exams, quizzes
CO2	Apply variational calculus techniques to solve problems involving optimization and constraint satisfaction	Ap	P	Problem sets, simulations
CO3	Analyze the Lagrangian formulation of classical mechanics and its equivalence to Newtonian mechanics	An	C	Homework assignments, exams
CO4	Derive and interpret the Euler-Lagrange equation and its solutions for various physical systems	An	P	Class discussions, presentations
CO5	Formulate and solve Hamilton's equations of motion for dynamical systems in phase space	Ap	P	Laboratory experiments, projects
CO6	Investigate the behavior of coupled oscillators and their dynamics using analytical and numerical methods	An	C	Research papers, presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**QUANTUM MECHANICS II**				
Type of Course	**Core in Major**				
Semester	**VII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Physical and Mathematics Concepts of Quantum Mechanics				
Course Summary	Delves deeper into the mathematical formalism and theoretical principles of quantum theory, exploring topics such as advanced wave function theory, scattering theory, perturbation theory,etc.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate Proficiency in Solving Schrödinger Equation Problems in Spherical Polar Coordinates.	Ap	P	Instructor-created exams / Quiz
CO2	Analyze Angular Momentum Concepts and Apply Them to Quantum Systems.	An	P	Practical Assignment / Observation of Practical Skills
CO3	Construct and Interpret Eigenvalues and Eigenfunctions of Angular Momentum Operators	C	P	Seminar Presentation / Group Tutorial Work

CO4	Evaluate Perturbation Theory Techniques for Solving Quantum Mechanical Problems.	E	P	Instructor-created exams / Home Assignments
CO5	Critically Analyze Scattering Phenomena and Predict Experimental Outcomes.	E	C	One Minute Reflection Writing assignments
CO6	Synthesize Advanced Quantum Mechanical Concepts to Solve Complex Problems.	C	M	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**STATISTICAL MECHANICS**				
Type of Course	**Core in Major**				
Semester	**VII**				
Academic Level	**400 – 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	A solid foundation in classical mechanics, quantum mechanics, and thermodynamics. Additionally, proficiency in calculus, differential equations, and linear algebra is essential for understanding the mathematical formalism used in statistical mechanics. A familiarity with probability theory and basic concepts of probability distributions can also be beneficial, as statistical mechanics involves the statistical analysis of large ensembles of particles to understand their collective behavior and properties.				
Course Summary	The course on statistical mechanics explores the principles governing the collective behaviour of large systems of particles, utilizing probabilistic methods to understand thermodynamic properties and the microscopic origins of macroscopic phenomena.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concept of multiplicity	U	C	Written exams, quizzes
CO2	Apply the second law of thermodynamics	Ap	P	Problem sets, lab experiments
CO3	Analyze changes in entropy in various systems	An	P	Case studies, simulations
CO4	Utilize Boltzmann statistics in statistical mechanics	Ap	P	Problem-solving exercises, projects
CO5	Employ quantum statistics in understanding systems	Ap	P	Research papers, presentations
CO6	Evaluate thermodynamic variables in complex systems	E	P	Research projects, oral exams

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**Electronics III**				
Type of Course	**Core in Major**				
Semester	**VII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY2CJ101- Electronics I and PHY6CJ305- Electronics II				
Course Summary	Exploration of cutting-edge concepts and methodologies in digital and analog electronics, delving into advanced topics such as high-frequency circuit design, mixed-signal systems, and emerging semiconductor technologies.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Understand the fundamental principles of analog and digital electronics.	U	C	Quizzes, Tests
CO2	Analyse different types of amplifiers and their applications.	An	P	Homework Assignments
CO3	Design amplifier circuits based on given specifications.	Ap	P	Laboratory Experiments
CO4	Analyse the operation of different types of FETs (JFETs, MOSFETs).	An	P	Homework Assignments
CO5	Understand the operational principles of Operational Amplifiers (Op-amps).	U	C	Quizzes, Assignments
CO6	Analyse and design sequential logic circuits using state diagrams and flip-flops.	An	P	Laboratory Experiments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**SOLID STATE PHYSICS**				
Type of Course	**Core in Major**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	The prerequisites for a course in solid state physics typically include a strong foundation in classical mechanics, electromagnetism, quantum mechanics, thermodynamics and statistical mechanics, and optionally solid state chemistry, along with recommended physics laboratory experience				
Course Summary	In a course on solid state physics, students delve into the fundamental principles governing the behavior of matter in its solid phase, exploring				

	topics such as crystal structures, electronic properties, thermal properties, magnetic phenomena, and their applications, with an emphasis on understanding the microscopic origins of macroscopic properties and phenomena observed in solid materials.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of crystal structures and their classification schemes	U	C	Written exams, quizzes
CO2	Analyze the electronic band structure of solids and its implications for electrical conductivity	An	P	Problem sets, simulations
CO3	Explain the principles of quantum mechanics as applied to solid state systems	U	C	Class discussions, presentations
CO4	Predict and interpret the thermal properties of solids using statistical mechanics	Ap	C	Laboratory experiments, projects
CO5	Investigate the magnetic properties of materials based on their atomic and electronic structures	An	P	Research papers, presentations
CO6	Apply solid state physics principles to real-world applications such as semiconductor devices	Ap	P	Case studies, group projects

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**SPECTROSCOPY**				
Type of Course	**Core in Major**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours

	4	4	-	-	60
Pre-requisites	Strong foundation in atomic structure, chemical bonding and electromagnetic radiation and also require knowledge of quantum mechanics.				
Course Summary	The molecular spectroscopy course covers the principles, techniques, and applications of analysing molecular structures and dynamics using various spectroscopic methods.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of molecular spectroscopy	U	C	Written exams, quizzes
CO2	Apply spectroscopic techniques to analyse molecules	Ap	P	Laboratory reports, projects
CO3	Interpret spectroscopic data accurately	An	P	Problem sets, case studies
CO4	Critically evaluate the limitations of spectroscopic methods	E	C	Research papers, presentations
CO5	Demonstrate proficiency in spectral interpretation	C	P	Oral exams, practical exams
CO6	Relate spectroscopic theory to real-world applications	Ap	C	Research projects, case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRODYNAMICS III**				
Type of Course	**Core in Major**				
Semester	**VIII**				
Academic Level	**400-499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60

Pre-requisites	Electrodynamics I and II
Course Summary	Students explore the intricate theoretical foundations and advanced applications of electromagnetism, delving into topics such as Maxwell's equations, electromagnetic waves, electromagnetic field theory, relativistic electrodynamics, and their applications in modern physics and engineering.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate mastery of Maxwell's equations and their applications in various contexts	Ap	P	Written exams, problem sets
CO2	Analyze electromagnetic wave propagation and interaction with matter using advanced mathematical techniques	An	P	Homework assignments, exams
CO3	Explain the physical significance of electromagnetic potentials and gauge transformations	U	C	Class discussions, presentations
CO4	Predict and interpret the behavior of electromagnetic fields in complex geometries and boundary conditions	An	P	Laboratory experiments, simulations
CO5	Apply relativistic electrodynamics principles to describe electromagnetic phenomena in the context of special relativity	Ap	P	Projects, research papers
CO6	Design and analyze advanced electromagnetic systems and devices, demonstrating creative problem-solving skills	C	P	Design projects, presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**
Course Title	**PRINCIPLES OF RESEARCH METHODOLOGY**
Type of Course	**Core in Major**
Semester	**VIII**

Academic Level	**400 – 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Major courses in first 6 semester				
Course Summary	This course equips students with the critical thinking skills and scientific methods to distinguish facts, design experiments, and analyze research.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Distinguish between scientific facts, generalizations, and pseudo-science, understanding the social nature of scientific activity and its role in democratic development.	U	C	Instructor-created exams / Quiz
CO2	Critically evaluate the limitations of science, including its underlying assumptions and challenges in defining reality and rationality.	E	P	Instructor-created exams / Quiz
CO3	Explain the key concepts of description, causality, prediction, and explanation in science, along with the role of mathematics in scientific endeavors.	U	C	Instructor-created exams / Quiz/Viva
CO4	Differentiate between hypotheses, theories, and laws, critically evaluating the processes of verification, falsification, acceptance, and peer review in the scientific method.	An	P	Instructor-created exams / Home Assignments
CO5	Apply principles of measurement, including operationalization (variables and indicators), to scientific research. Students will be able to evaluate the validity, reliability, and reproducibility/replicability of measurements and identify potential sources of error.	Ap	P	Home Assignments
CO6	Design and analyze experiments, understanding the roles and limitations of experimentation, including natural, manipulative, and comparative approaches. Students will be able to assess the validity and reliability of	C	M	Seminar/ Viva

	experiments using appropriate epistemological strategies.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

MAJOR ELECTIVE COURSES

Programme	**B.Sc. Physics Honours**				
Course Title	**PROPERTIES OF SOLIDS**				
Type of Course	**Major Elective (Specialization 1: Materials Science)**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	The prerequisites for the course on crystal structure, theory of solids, semiconductor properties, and dielectric and magnetic properties of solids include a solid foundation in physics, mathematics, quantum mechanics, chemistry, electricity, and magnetism.				
Course Summary	The course provides a comprehensive study of crystal structure, theory of solids, semiconductor properties, and dielectric and magnetic properties of solids, aiming to understand the fundamental principles governing the behavior of materials in these domains.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate an understanding of crystal structures and their impact on material properties	Ap	C	Examinations, Assignments
CO2	Analyze the theoretical models of solids and their applicability to real-world scenarios	An	P	Problem Sets, Case Studies
CO3	Evaluate semiconductor properties and their role in electronic device functionality	E	P	Laboratory Experiments, Projects
CO4	Explain the principles underlying dielectric properties of solids and their technological applications	U	C	Presentations, Written Reports
CO5	Investigate magnetic properties of solids and their implications in magnetic storage and sensing technologies	E	P	Research Papers, Presentations
CO6	Synthesize knowledge of crystal structure, theory of solids, semiconductor, dielectric, and magnetic properties to propose solutions to complex material-related problems	C	M	Capstone Projects, Oral Defenses

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**MATERIALS SCIENCE**				
Type of Course	**Major Elective (Specialization 1: Materials Science)**				
Semester	**V**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	A strong foundation in physics and chemistry.				
Course Summary	This course aims to provide students with a comprehensive understanding of the fundamental principles underlying the behavior of materials, as well as the cutting-edge technologies driving innovation in this field.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the various types of materials, the bonding between the elements and molecules, and type of interacting forces among the molecular systems	An	F	Instructor-created exams / Quiz
CO2	Develop a fundamental understanding of the importance of the structure of the compounds and performance of materials.	R	F	Instructor-created exams / Quiz
CO3	Gain knowledge about the different types of materials that are used in different applications and the different properties of diversified materials.	Ap	F	Instructor-created exams / Quiz
CO4	Familiarize students with advanced characterization techniques used to analyze materials structurally, surface, optically, electrically and magnetically.	An	F	Instructor-created exams / Quiz

CO5	Explore the applications of advanced materials in various industries, energy technology, and electronic and other applications..	An	F	Instructor-created exams / Quiz
CO6	Make the students capable of developing various materials through project work.	Ap	F	Instructor-created exams / Quiz

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**NANOSCIENCE AND TECHNOLOGY**				
Type of Course	**Major Elective (Specialization 1: Materials Science)**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY5EJ302(1)- Materials Science				
Course Summary	This Nanoscience and Technology aims to provide students with a solid foundation in the principles, techniques, and applications of nanotechnology, preparing them for careers in research and industry.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understanding of Nanoscale Phenomena, the unique properties and behaviors of materials at the nanoscale.	U	F	Instructor-created exams / Quiz
CO2	Understand the science of nanomaterials: including quantum effects, surface phenomena, and size-dependent properties.	Ap	F	Instructor-created exams / Quiz
CO3	Understand the knowledge about the type of nanomaterials and how the size effect affects the transport properties in nanomaterials	An	F	Instructor-created exams / Quiz
CO4	Knowledge of Nanofabrication Techniques: Students should learn about various techniques used to fabricate	U	F	Instructor-created exams / Quiz

	nanostructures and nanomaterials, such as top-down and bottom-up approaches.			
CO5	To familiar with a range of characterization techniques used to analyze nanomaterials and nanostructures using conventional and advanced techniques.	An	F	Instructor-created exams / Quiz
CO6	Research Skills: Depending on the level of the course, students may develop research skills through laboratory work, independent projects, or literature reviews.	Ap	F	Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**OPTOELECTRONICS AND SEMICONDUCTOR DEVICES**				
Type of Course	**Major Elective (Specialization 1: Materials Science/ Specialization II: Photonics)**				
Semester	**VI**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY5EJ302(1)- Materials Science				
Course Summary	The Optoelectronics and Semiconductor Devices course focuses on equipping students with an understanding of the principles, operation, design, and applications of optoelectronic devices and semiconductor devices.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understanding the operation and characteristics of various optoelectronic devices, such as light-emitting diodes (LEDs), laser diodes, etc	U	F	Instructor-created exams / Quiz
CO2	Understanding of semiconductor physics, including band theory,	R	F	Instructor-created exams / Quiz

	carrier transport, and semiconductor device operation principles.			
CO3	Understand the knowledge about the radiative transition processes and other optoelectronic phenomenon.	Ap	F	Instructor-created exams / Quiz
CO4	Understand the applications of optoelectronic and semiconductor devices in various fields such as telecommunications, imaging, sensing, displays, and energy conversion.	An	F	Instructor-created exams / Quiz
CO5	To be familiar with equipment and devices that work on the principle of semiconducting phenomena and theories of optoelectronics	Ap	F	Instructor-created exams / Quiz
CO6	Students will gain hands-on experience through laboratory experiments involving the characterization and testing of optoelectronic and semiconductor devices	An	F	Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**PHOTONICS**				
Type of Course	**Major Elective (Specialization II: Photonics)**				
Semester	**V**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Fundamental knowledge in Optics				
Course Summary	Photonics is the science and technology of generating, controlling, and detecting photons, which are particles of light. This course covers topics such as the fundamentals of light-matter interaction, optical components and systems, laser technology and fiber optics. It's a multidisciplinary field that combines elements of physics, optics and materials science to harness light for a wide range of practical purposes.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concept and principles of energy levels, spontaneous emission and stimulated emission, optical gain, and threshold condition for lasing.	U	C	Written exams and quizzes
CO2	Understand the principles and working of various laser systems.	An	P	Presentations, written exam
CO3	Giving a rigorous theoretical background and framework for a nonlinear optical effect, followed by details of how such an effect is implemented in real applications.	U	C	Written exams, Assignments
CO4	Understand the physical principles of optical fiber and the loss mechanisms in optical fiber. Demonstrate the understanding of fiber optic sensors.	Ap	C	Written exams and quizzes, experiments
CO5	Apply Photonics principles to real-world applications such as lasers and Optical fiber	Ap	C	Simple projects

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge (F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**INTRODUCTORY MOLECULAR SPECTROSCOPY**				
Type of Course	**Major Elective (Specialization II: Photonics)**				
Semester	**V**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY4CJ205- Modern Physics				
Course Summary	Introductory Molecular Spectroscopy provides a comprehensive overview of the principles governing the interaction between light and molecules. Students delve into spectroscopic techniques such as infrared, ultraviolet-visible, and nuclear magnetic resonance spectroscopy, gaining insights into molecular structure, dynamics, and interactions.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Gain basic knowledge on electromagnetic spectrum, spectral lines and diverse branches in spectroscopy	U	C	Viva Voce/ Seminar / Quiz
CO2	Gain theoretical know-how on rotational spectrum of diatomic and polyatomic molecules	An	P	Practical Assignment / Group Discussion
CO3	Gain theoretical know-how on vibrational spectrum of diatomic and polyatomic molecules	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Gain theoretical know-how on vibrating rotators and Born-Oppenheimer approximation	An	P	Instructor-created exams / Home Assignments
CO5	Gain theoretical know-how on Raman spectrum	Ap	M	Viva Voce
CO6	Gain practical knowledge on emission and absorption spectra	C	M	Group Discussion/ Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**BIOPHOTONICS**				
Type of Course	**Major Elective (Specialization II: Photonics)**				
Semester	**V**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Fundamental knowledge in optics, photonics and biology				
Course Summary	Biophotonics is an interdisciplinary field that combines principles of physics, biology, and optics to study biological systems using light-based techniques. This course covers topics such as optical properties of biological tissues, imaging and biosensing techniques, instrumentation,				

	and emerging trends. Students gain both theoretical knowledge and practical skills through lectures, and projects/lab, preparing them for careers in research, healthcare, and technology development.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understanding photobiology contributes to advancements in medical treatments, such as photodynamic therapy using exogenous photosensitizers.	U	C	Written exams, quizzes
CO2	Imaging in the field of biophotonics provides a comprehensive understanding of visualization techniques at various scales within the biological system.	An	p	Quizes, presentations
CO3	Studying the principles of optical biosensing, equips individuals with the knowledge to design, develop, and apply advanced sensing technologies.	Ap	C	Written exams, experiments
CO4	Understanding the techniques of a flow cytometer, tweezers, optical responses, and the principles of photodynamic therapy fosters the development of advanced diagnostic and therapeutic techniques. Additionally, exploring This knowledge contributes to advancements in both clinical diagnostics and biological research.	Ap	C	Written exams, quizzes
CO5	Apply Photonics principles to real-world applications such as imaging and sensors	Ap	C	Mini Projects
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge (F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**

Course Title	**PHYSICS OF THE HUMAN BODY**				
Type of Course	**Major Elective (Specialization III: Physics in Biology)**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Newtonian mechanics.				
Course Summary	This course analyses the human body from the viewpoint of mechanics and its static and dynamic equilibrium. The effects of collisions on human body, leading to fractures are explored. The significance of muscles of the human body is also analysed.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand & apply the laws of mechanics to the human body w.r.to its static equilibrium.	Ap	F	Instructor-created exams / Quiz
CO2	Understand dynamic equilibrium of human body.	U	F	Instructor-created exams / Quiz
CO3	Understand and analyse the effects of collision of human body from a mechanical force viewpoint.	An	F	Instructor-created exams / Quiz
CO4	Gain basic knowledge about various supporting structures of bones, a.k.a Ligaments, Tendons, Cartilage and how energy is stored in them.	U	F	Instructor-created exams / Quiz
CO5	Basic understanding of fractures from mechanical force viewpoint.	An	F	Instructor-created exams / Quiz
CO6	Gain ideas about muscle and muscle activity from a mechanical viewpoint.	Ap	F	Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**INTRODUCTORY MEDICAL PHYSICS**				
Type of Course	**Major Elective (Specialization III: Physics in Biology)**				
Semester	**V**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	A strong foundation in physics, mathematics, and basic biology concepts.				
Course Summary	The medical physics course provides an interdisciplinary exploration of the application of physics principles to medical imaging, radiation therapy, and radiation protection, emphasizing the theoretical and practical aspects essential for understanding and contributing to advancements in medical diagnostics and treatment.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concept of biometrics	U	C	Written exams, quizzes
CO2	Analyse bioelectric potentials	An	C	Laboratory reports, projects
CO3	Identify and explain the major physiological process	U	C	Presentations, written exams
CO4	Understand the principles of medical imaging	U	C	Practical assessments, exams
CO5	Apply the principles of medical imaging	Ap	P	Case studies, laboratory work
CO6	Evaluate the cognitive and technical aspects of radiation therapy	E	M	Oral exams, practical exams

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**INTRODUCTORY BIOPHYSICS**				
Type of Course	**Major Elective (Specialization III: Physics in Biology)**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Higher Secondary level Physics 2. Fundamental Mathematics Concepts: Concept of calculus- Solution of very simplest differential equation 3. High school level Chemistry and Biology				
Course Summary	In this course the student learn a bridge between Physics and Biology. Look at some of the biological phenomena and analyze them with math and physics to gain important insights. This course tries to show that there is a quantitative, Physical sciences approach to Biological problems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain why is nano world so different from macro world and predict what's going on there by incorporating physical ideas like Random walk, Diffusion, probabilistic facts, etc.	U	C	Instructor-created exams, Assignments
CO2	Explain the biological systems and models by dealing with statistical mechanics and transport phenomena	U	C	Instructor-created exams
CO3	Answer many real life questions like why don't bacteria swim like fish by applying equation of motion appropriate to the nano world	Ap	P	Instructor-created exams, Assignments
CO4	Explain the thermodynamic basis of various biochemical reactions in cells and tissues.	U	F	Instructor-created exams

CO5	Analyse the role of action potential in nerve impulses, and the physics of signal communication via neural systems.	Ap	P	Instructor-created exams
CO6	Explain everyday phenomena and various processes in living systems by applying physical principles	An	C	Assignments/ Seminar presentations
CO7	Make quantitative predictions by making a simplified model by applying many tools given in the course	C	M	Assignment/ Group Projects/Presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**APPLIED NUCLEAR PHYSICS**				
Type of Course	**Major Elective (SPECIALIZATION IV: DATA SCIENCE AND ARTIFICIAL INTELLIGENCE)**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Fundamental ideas in mechanics, electromagnetism, and mathematical physics along with the basic understanding of concepts in modern physics like atomic and nuclear structure.				
Course Summary	The course in Applied Nuclear Physics provides an in-depth account of the fundamental constituents of matter, their interactions, and the underlying principles governing nuclear structure, particle behaviour, and their implications in different walks of modern technology.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Understand Radioactive Processes: Explain the mechanisms and types of radioactive decay. Understand internal conversion and their roles in radioactive decay chains and environmental radioactivity.	U	C	Quizzes, Tests
CO2	Analyze Nuclear Collisions and Reactions: Describe nuclear collision processes, understand nomenclature and probes, calculate cross sections and reaction rates, and discuss examples of isotope production and nuclear reactions, including elastic scattering and resonance.	An	P	Homework Assignments
CO3	Apply Radiation Interaction Principles: Utilize the Bethe-Bloch formula to predict energy loss of heavy charged particles in matter, interpret Bragg curves, and analyze the dependence on projectile and medium. Understand gamma-ray attenuation and neutron interaction processes including attenuation and moderation.	Ap	C	Problem Sets, Projects
CO4	Explore Neutron Physics: Discuss the properties of neutrons, classify different types of neutrons, and understand the various sources of neutrons. Use neutron detectors like the BF3 counter.	An	P	Homework, Exams
CO5	Assess Biological Effects of Radiation: Evaluate the biological impacts of radiation exposure, differentiate between direct and indirect physical and chemical damage, calculate dose and dose rate, and understand dose distribution and its relative biological effectiveness. Assess human exposure from natural and artificial sources.	U	F	Virtual lab Demonstrations

CO6	Utilize Radiation in Industrial and Analytical Applications: Demonstrate the use of radiation in industrial applications. Apply analytical techniques for materials analysis.	Ap	C	Problem Sets, Projects

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B. Sc. Physics Honours**				
Course Title	**FOUNDATIONS OF DATA SCIENCE**				
Type of Course	**Major Elective (SPECIALIZATION IV: DATA SCIENCE AND ARTIFICIAL INTELLIGENCE)**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Programming Concepts in Python 2. Basic idea of linear algebra				
Course Summary	The course will introduce the fundamental concepts of linear algebra, probability and statistics required for a program in data science				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Students will evaluate eigenvalues and eigenvectors to decompose matrices, enabling them to analyze and interpret data transformations effectively	An	P	instructor created exams / Assignment
CO2	proficiency in solving linear	Ap	P	Instructor created exams /

	equations using linear algebra and understanding the geometric interpretation of solutions.			Assignment
CO3	students will apply fundamental probability concepts to solve real world problems	Ap	P	Assignment / Quiz
CO4	studentswill utilize statistical techniques for data interpretation and decision-making.	Ap	P	Instructor created exams / Assignment
CO5	Studentswill apply sampling techniques and hypothesis tests to make inferences about populations from sample data, using one-tailed, wo-tailed tests, and ANOVA for analysis.	Ap	C	Assignment / Case Studies
CO6	Develop critical thinking and problem-solving skills	E	M	Assignment / Case Studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create(C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**EXPLORATORY DATA ANALYSIS USING PYTHON**				
Type of Course	**Major Elective (SPECIALIZATION IV: DATA SCIENCE AND ARTIFICIAL INTELLIGENCE)**				
Semester	**V**				
Academic Level	**300 -399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60

Pre-requisites	1. Fundamental Programming Concepts in Python 2. Basic idea of Statistics
Course Summary	This course provides insight into the basic concepts of data analysis and different visualization tools and techniques and teaches the application of these techniques using Python packages.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the types of data and the applications of data science	U	C	Instructor-created exams / Quiz
CO2	Analyse the irregularities present in the data and perform data cleaning	An	C	Problem-solving assessments
CO3	Become familiar with data format & programs used in data analysis	U	F	Practical Assignment / Observation of Practical Skills
CO4	Understand & apply Pandas module for data analysis	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO5	Understand & apply Seaborn module for data visualization	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO6	Learners will develop skills in advanced features of spreadsheets such as macros, protecting data sheets and workbooks, utilizing split, freeze, and hide options effectively	Ap	P	Assignments/ Case Studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create(C)
# - Factual Knowledge(F) Conceptual Knowledge (C)
Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B. Sc. Physics Honours**				
Course Title	**FOUNDATIONS OF ARTIFICIAL INTELLIGENCE**				
Type of Course	**Major Elective (SPECIALIZATION IV: DATA SCIENCE AND ARTIFICIAL INTELLIGENCE)**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practica L per week	Total Hours
	4	4	-	-	60
Pre-requisites	Awareness of algorithmic approaches				
Course Summary	The course introduces the concept of artificial intelligence. The various knowledge representation and Knowledge Inference methods are introduced. The course introduces the application of AI in various fields.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Able to gain insight into the evolution of key ideas and technologies by exploring Artificial Intelligence history and its foundational concepts.	U	C	Instructor created exams /Quiz/Assignment/ Seminar
CO2	Able to acquire knowledge and skills to understand, design, implement intelligent agents to perceive, reason and act within their environments.	U	C	Instructor created exams/ Quiz/Assignment/ Seminar
CO3	Proficiency in various uninformed and informed search strategies along with constraint satisfaction problem solving methods.	U	C	Instructor created exams/ Quiz/Assignment/ Seminar

CO4	Ability to design and implement logical agents and construct ontologies that capture the semantics of a domain, facilitating knowledge representation.	U	C	Instructor create d exams/ Quiz/Assignment/ Seminar
CO5	Understand the ethical considerations of AI and their societal impacts and gain insights into the future trajectory of AI by analysing the emerging trends.	U	C	Instructor created exams/ Quiz/Assignment/ Seminar
CO6	Represent various AI problems using algorithmic approaches and enhance problem-solving skills by visualizing solutions through the utilization of software tools.	Ap	C, P	Practical Assignment / Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B. Sc. Physics Honours**				
Course Title	**MACHINE LEARNING USING PYTHON**				
Type of Course	**Major Elective (SPECIALIZATION IV: DATA SCIENCE AND ARTIFICIAL INTELLIGENCE)**				
Semester	**VI**				
Academic Level	**300 -399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Awareness of algorithmic approaches 2. Data Analysis Using Python				
Course Summary	This course deals with various algorithms to enable computers to learn data without being explicitly programmed. An insight into various types of machine learning algorithms, strategies for model generation and evaluation are given in this course.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concepts and importance of Machine Learning, its types	U	C	Instructor created exams / Quiz
CO2	Understand & apply Scikit-learn module for Machine Learning	Ap	P	Instructor created exams, Observation of Practical Skills
CO3	Understand the supervised learning algorithms and its application	Ap	P	Instructor created exams/ Quiz/Assignment/ Seminar
CO4	Understand the unsupervised learning algorithms and its application	Ap	P	Instructor created exams/ Quiz/Assignment/ Seminar
CO5	Understand the semi supervised learning algorithms and its application	Ap	P	Practical assignments and practical tests
CO6	Develop critical thinking skills to analyze and solve complex problems using machine learning approaches	Ap	P	Practical assignments and practical tests

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create(C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ASTROPHYSICS**				
Type of Course	**Major Elective**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60

Pre-requisites	PHY4CJ205 Modern Physics
Course Summary	This course gives a pedagogical introduction to astronomy and astrophysics by introducing the students the techniques to measure astronomical parameters, the properties of the Sun, stellar evolution and properties of galaxies and an overview of the Universe.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate a deep understanding of theoretical frameworks in astronomy, including celestial mechanics, stellar structure, and cosmology.	U	C	Instructor-created exams / Quiz
CO2	Apply basic physical principles from a broad range of topics in physics to address complex astronomical phenomena.	Ap	P	Viva Voce / Home Assignments/ Seminar Presentations
CO3	Get knowledge of positional astronomy, astronomical parameters and tools.	U	C	Instructor-created exams / Quiz
CO4	Able to explain the physics of Sun and the evolution of stars.	U	C	Instructor-created exams / Quiz
CO5	Describe the morphology and classification of galaxies and galaxy clusters.	U	C	Instructor-created exams / Quiz
CO6	Expose scientific knowledge about the origin and evolution of the universe.	U	C	Instructor-created exams / Quiz

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**
Course Title	**SPACE PHYSICS**
Type of Course	**Elective in Major**
Semester	**VI**

Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY4CJ205- Modern Physics				
Course Summary	This course introduces the student to Space Physics. The various subdisciplines of the topic such as structure and properties of the solar system with emphasis on Earth and the Sun and their magnetic fields, the elements of planetary science, the rudiments of space weather as well as basics of space flight dynamics are dealt with in detail.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic structure and parameters of the Earth and the Sun including their atmospheres and their magnetic fields	U	C	Instructor-created exams / Quiz
CO2	Understand the basic elements of planetary science including the structure of the solar system and the classification of its constituents	U	C	Viva Voce / Home Assignments/Seminar Presentations
CO3	Understand the basics of space weather and its various phenomena such as solar wind, interplanetary space and solar activities like coronal mass ejections	U	C	Instructor-created exams / Quiz
CO4	Understand the theory behind the orbital dynamics and the technology of rocket and spacecraft propulsion	Ap	C	Instructor-created exams / Quiz
CO5	Interpret the complex structures and dynamics of Earth's magnetosphere, including the polar cusp, plasma sheet, ring current, radiation belts, and associated wave phenomena.	Ap	C	Instructor-created exams / Quiz

CO6	Equip with the knowledge and skills necessary to apply principles of space science in analyzing and understanding various phenomena within our solar system and beyond.	U	C	Instructor-created exams / Quiz

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ATMOSPHERIC PHYSICS**				
Type of Course	**Major Elective**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic thermodynamics. 2. Basic electrostatics.				
Course Summary	This course explores the structure and dynamics of the Earth's atmosphere. The vertical structure of the atmosphere, atmospheric thermodynamics, Earth's heat and radiation budget as well as atmospheric electricity are discussed. Basics of climate change and atmospheric photochemistry are also introduced.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic structure of the atmosphere and its constituents stratified to several layers. Understand rainfall, its distribution as well as the role played by winds.	R	F	Instructor-created exams / Quiz
CO2	Obtain basic idea of global warming. Apply the concepts of pressure, temperature, humidity to atmosphere and their role in climate change.	Ap	P	Instructor-created exams / Quiz
CO3	Apply thermodynamical concepts and latent energy to analyse stability of air parcel	An	C	Instructor-created exams / Quiz

CO4	Understand the atmospheric energy budget and the role played by radiation in it.	Ap	F	Instructor-created exams / Quiz
CO5	Understand basic atmospheric photochemistry and the role of trace gases.	U	F	Instructor-created exams / Quiz
CO6	Understand cloud physics and thunderstorm electricity. Apply the concept of electric field to atmosphere in the form of lightning and learn about lightning protection measures.	Ap	P	Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**QUANTUM COMPUTATION AND QUANTUM INFORMATION**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 – 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Linear Algebra 2. Basic Quantum Mechanics				
Course Summary	The Quantum Computation and Quantum Information course provides students with a comprehensive understanding of quantum computing and quantum information theory. Fundamental principles including superposition, entanglement, and quantum gates are explored, laying the groundwork for quantum computation. Students delve into advanced quantum algorithms such as Shor's and Grover's algorithms, which promise exponential speedup over classical counterparts for specific tasks. Additionally, the course examines practical applications like quantum teleportation, super dense coding, quantum error correction, and quantum key distribution, showcasing the real-world implications of quantum information processing. By the end of the course, students				

	emerge equipped with both theoretical knowledge and practical insights, positioning them at the forefront of this rapidly evolving field.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Comprehensive Understanding of Mathematical Formulations of Quantum Mechanics.	U	C	Viva Voce/ Seminar / Quiz
CO2	Proficiency in Analyzing and Utilizing Entanglement.	An	P	Practical Assignment / Group Discussion
CO3	Mastery of Quantum Gates and Circuits.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Application of Entanglement and Management of Quantum Noise.	An	P	Instructor-created exams / Home Assignments
CO5	Proficient Use of Tools in Quantum Information Theory.	Ap	M	Viva Voce
CO6	Integration and Application of Quantum Concepts in Practical Scenarios.	C	M	Group Discussion/ Quiz

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN PHYSICS**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Programming Concepts in Python 2. Basic idea of statistics and linear algebra				
Course Summary	This course explores the fundamentals of Artificial Intelligence and Introduces the basic concepts of Machine Learning Techniques. Also explores various clustering, classification and regression techniques.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Grasp the concepts and importance of Artificial Intelligence, historical context and how the brain processes information.	U	C	Instructor-created exams / Quiz
CO2	Acquire a solid understanding of machine learning principles, algorithms, and evaluation techniques and apply them effectively to real-world problems.	U	C	Instructor-created exams / Home Assignments
CO3	Understand neural networks, perceptron, linear regression, and multilayer perceptron (MLP) and practical implementation for real-world problems using MLP.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Acquire a comprehensive understanding of deep learning models, their comparison with traditional machine learning, various types of deep neural networks and their architecture.	U	C	Instructor-created exams / Home Assignments
CO5	Design and develop machine learning models using Keras and MLP for various problems in the real world.	Ap	P	Practical Assignment / Observation of Practical Skills

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**DIGITAL SIGNAL PROCESSING**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Mathematics Concepts: sequences and Series, Integration, Matrices. Fourier Theorem 2. Basic idea of transducers.				

Course Summary	This course outlines the fundamentals of signal processing by digital means.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the characteristics of discrete-time signals and systems.	U	C	Quizzes, homework assignments, exams
CO2	Apply the Z-transform to analyse discrete-time signals and systems.	Ap	P	Problem-solving exercises, projects
CO3	Analyse the frequency content of discrete-time signals using the Z-transform.	An	C	Homework assignments, exams
CO4	Design discrete-time filters for specific signal processing tasks.	C	M	Laboratory assignments, projects
CO5	Implement signal processing algorithms using digital signal processing tools.	Ap	P	Projects, simulations
CO6	Interpret and evaluate the performance of signal processing systems.	E	C	Case studies, presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**DIGITAL ELECTRONICS**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 – 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY2CJ101- ELECTRONICS I & PHY6CJ305- ELECTRONICS II				
Course Summary	The course covers the design and analysis of combinational logic circuits, sequential circuits using flip-flops, counters, and registers, as well as techniques for interfacing digital systems with the analog world, providing a comprehensive understanding of digital logic design principles and applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Design and analyze combinational logic circuits	Ap	P	Homework assignments, exams
CO2	Implement sequential circuits using flip-flops	Ap	P	Laboratory experiments, projects
CO3	Design and construct various types of counters	C	P	Design projects, simulations
CO4	Analyze the operation of registers in digital systems	U	C	Quizzes, concept tests
CO5	Interface digital systems with analog components	Ap	P	Case studies, practical exams
CO6	Evaluate and troubleshoot digital-analog interfaces	An	P	Laboratory reports, demonstrations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**COMMUNICATION ELECTRONICS**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 -- 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY2CJ101- ELECTRONICS I & PHY6CJ305- ELECTRONICS II				
Course Summary	Communication Electronics delves into the theory and practical implementation of electronic circuits and systems used in telecommunications, covering topics such as modulation techniques, signal processing, and transmission line theory, to facilitate efficient and reliable communication networks.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate an understanding of amplitude and frequency modulation techniques and their applications	U	C	Examinations, Assignments
CO2	Apply pulse and digital modulation techniques to design and analyze communication systems	Ap	P	Problem Sets, Lab Reports

CO3	Analyze the components and operation of radio transmitters, receivers, and antennas in communication systems	An	P	Research Papers, Projects
CO4	Evaluate the principles and techniques of digital signal processing as applied to communication systems	E	P	Presentations, Discussions
CO5	Explain the functionality and characteristics of radio transmitters, receivers, and antennas	U	C	Written Reports, Essays
CO6	Synthesize knowledge of modulation techniques, radio systems, and digital signal processing for designing and implementing communication systems	C	P	Capstone Projects, Oral Defenses
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**PLASMA PHYSICS**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	A strong foundation in classical mechanics, electromagnetism, quantum mechanics, and fluid dynamics is essential as prerequisites for the course in plasma physics.				
Course Summary	The course in plasma physics provides an in-depth exploration of the behavior, properties, and applications of ionized gases, encompassing fundamental theories, experimental techniques, and practical implications across various fields such as astrophysics, fusion research, and industrial plasma technologies.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate an understanding of the basic principles of plasma physics, including plasma formation and properties	U	C	Examinations, Assignments

CO2	Apply fluid dynamics concepts to analyze the behavior of plasmas and the propagation of waves within them	Ap	P	Problem Sets, Lab Reports
CO3	Analyze the equilibrium and stability of plasma systems using relevant theoretical models and mathematical techniques	An	P	Research Papers, Projects
CO4	Evaluate plasma behavior and interactions based on kinetic theory, considering particle distribution functions and collisional processes	E	P	Presentations, Discussions
CO5	Explain the physical mechanisms underlying wave propagation and instabilities in plasmas, considering both linear and nonlinear effects	U	C	Written Reports, Essays
CO6	Synthesize knowledge of plasma physics theories and principles to propose solutions to complex plasma-related problems in various applications	C	M	Capstone Projects, Oral Defenses
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**NONLINEAR DYNAMICS AND CHAOS**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Numerical Techniques, Classical Mechanics				
Course Summary	To understand the nonlinear dynamics and chaotic theory				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Understanding of Nonlinear Dynamics	U	F	Internal Exam
CO2	Analyze the behavior of dynamical systems	Ap	P	Internal Exam
CO3	Exploration of Chaos Theory	U	C	Internal Exam
CO4	Numerical Analysis Skills	An	P	Internal Exam, Assignment
CO5	Apply the techniques of nonlinear dynamics to physical processes	Ap	P	Internal Exam, Assignment
CO6	Carry out simulation of Nonlinear systems	E	P	Assignemt,Internal Exam
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**INTRODUCTORY GENERAL RELATIVITY**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 – 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Special relativity. 2. Tensors.				
Course Summary	This course introduces Einstein's general theory of relativity in a quantitative manner. The mathematical foundations required are developed before discussion of the theory. The mathematical concept behind black holes is also introduced.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Review of tensors, as well as understand tensor calculus	U	C	Instructor-created exams / Quiz
CO2	Understand the metric tensor and how curved spacetime is described by the metric tensor.	Ap	C	Instructor-created exams / Quiz
CO3	Understand Christoffel's symbols and the Riemann–Christoffel curvature tensor.	Ap	C	Instructor-created exams / Quiz / Home Assignments.

CO4	Understand how Parallel displacement can be used to detect curvature.	Ap	C	Instructor-created exams / Quiz
CO5	Understand equivalence principle and principle of general covariance to arrive at Einstein's equations	U	C	Instructor-created exams / Quiz
CO6	Understand the basic mathematical theory behind black holes.	U	C	Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**INTRODUCTORY QUANTUM FIELD THEORY**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY5CJ303- Quantum Mechanics I and PHY7CJ403- Quantum Mechanics II				
Course Summary	The course provides a comprehensive overview of classical field theory, followed by a detailed exploration of the quantization processes for scalar fields, Dirac fields, and the electromagnetic field, aiming to elucidate the fundamental principles underlying modern theoretical physics				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate an understanding of classical field theory and its applications in describing physical phenomena	U	C	Examinations, Assignments

CO2	Apply quantization techniques to scalar fields, Dirac fields, and the electromagnetic field	Ap	P	Problem Sets, Lab Reports
CO3	Analyze the consequences of field quantization on particle interactions and quantum field theory	An	P	Research Papers, Projects
CO4	Evaluate the mathematical formalism of field quantization and its consistency with experimental observations	E	C	Presentations, Discussions
CO5	Explain the implications of field quantization for relativistic quantum mechanics and gauge theories	U	C	Written Reports, Essays
CO6	Synthesize knowledge of classical field theory and field quantization to propose solutions to theoretical problems in modern physics	C	M	Capstone Projects, Oral Defenses

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

Programme	B.Sc. Physics Honours				
Course Title	**NUCLEAR PHYSICS**				
Type of Course	**Major Elective**				
Semester	**VIII**				
Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	PHY6CJ303: NUCLEAR AND PARTICLE PHYSICS				
Course Summary	This course explores advanced nuclear and particle physics.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Interpret the properties of nucleus, binding energy, angular momentum, two-nucleon scattering, spin dependence, tensor force, partial wave concept and theory of deuteron structure	An	C	Instructor-created exams / Quiz
CO2	Elucidate the theory of various types of nuclear decay, selection rules of transition, concept of parity and multipole moments.	U	C	Instructor-created exams / Quiz
CO3	Comparison of various nuclear models.	An	P	Instructor-created exams / Home Assignments
CO4	Comparison of nuclear processes like fission and fusion and the concept of nuclear reactor.	An	P	Instructor-created exams / Home Assignments
CO5	Demonstrate the working of one or two nuclear radiation detectors of different types	Ap	P	Seminar Presentation / Group Tutorial Work
CO6	Compare basic interactions and classify the elementary particles. Interactions are linked with the concept of symmetry and conservation laws. Understand Sakata model, Gellmann- Okubo mass formula, Quark mode and their significance.	An	P	Seminar Presentation / Group Tutorial Work /Group Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

MINOR COURSES

Programme	**B.Sc. Physics Honours**				
Course Title	**MECHANICS AND OPTICS**				
Type of Course	**Minor (GROUP I: MATHEMATICS FOR PHYSICAL SYSTEMS)**				
Semester	**I**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Fundamentals of vectors, calculus and kinematics.				
Course Summary	This course explores Newton's Laws of Motion and how they can be applied to solve different mechanical systems, and also discusses various phenomena exhibited by light.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply Newton's Laws of Motion to solve different mechanical systems	Ap	P	Instructor-created exams / Home Assignments
CO2	Apply work-energy theorem to solve different mechanical systems	Ap	P	Instructor-created exams / Home Assignments
CO3	Analyse conservative systems and solve them using the conservation of mechanical energy.	An	P	Instructor-created exams / Home Assignments
CO4	Understand the basic nature and different phenomena exhibited by light.	U	C	Instructor-created exams / Home Assignments
CO5	Develop a skill to analyse the behaviour of light beams in devices consisting of mirrors and lenses.	Ap	P	Seminar Presentation / Group Tutorial Work
CO6	Develop skills to set up and perform experiments to test Newton's Laws of Motion, work energy theorem and different phenomenon exhibited by light.	C	P	Practical Assignment / Observation of Practical Skills / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)				

- Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTROMAGNETISM AND NETWORK THEOREMS**				
Type of Course	**Minor (GROUP I: MATHEMATICS FOR PHYSICAL SYSTEMS)**				
Semester	**II**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Fundamentals of vector algebra, calculus and basic electronics				
Course Summary	This course explores different characteristics of electric and magnetic fields, application of network theorems for solving various electrical networks and behaviour of circuit components in ac circuits.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Revise the concept of charge, coulomb force, electric field, electric dipole and apply Gauss theorem for calculating electric field.	Ap	P	Instructor-created exams / Home Assignments
CO2	Identify the sources of magnetism, explain properties of magnetic forces, behaviour of charged particles in magnetic field and apply Amperes law for calculating magnetic field.	Ap	P	Instructor-created exams / Home Assignments
CO3	Analyse various network theorems and apply these theorems for solving complex electrical circuits.	An	P	Instructor-created exams / Home Assignments
CO4	Analyse the behaviour of various electrical components like resistors, capacitors and inductors in pure ac circuit.	An	P	Instructor-created exams / Home Assignments

CO5	Design and analyse the behaviour of ac circuits with more than one electrical component.	An	P	Seminar Presentation / Group Tutorial Work
CO6	Develop skills to set up and perform experiments to analyse different properties of electric and magnetic field. Design and construct ac circuits consisting various circuit elements and analyse its properties.	Ap	M	Practical Assignment / Observation of Practical Skills / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**MATHEMATICAL METHODS FOR PHYSICS**				
Type of Course	**Minor (GROUP I: MATHEMATICS FOR PHYSICAL SYSTEMS)**				
Semester	**III**				
Academic Level	**200 –299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Fundamentals of vectors, linear algebra, differential equations coordinate systems and familiarity with basic concepts in physics.				
Course Summary	This course explores fundamental principles and applications of vector analysis, complex functions, differential equations and curvilinear coordinates in electromagnetism and engineering contexts.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Students will attain a strong foundational understanding about vector calculus, complex numbers, differential equations and curvilinear coordinates	U	C	Instructor-created exams / Quiz
CO2	Students will develop analytical proficiency which enables them to analyse and interpret complex physical phenomena through the application of mathematical principles.	Ap	M	Practical Assignment / Observation of Practical Skills

CO3	Students will cultivate advanced problem-solving skills.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Students will enhance their ability to model and represent physical systems mathematically for describing and understanding complex phenomena.	Ap	M	Practical Assignment / Observation of Practical Skills / Home Assignments
CO5	Students will recognize and appreciate the interdisciplinary applications of mathematical methods.	Ap	M	Seminar Presentation / Group Discussion
CO6	Students will refine their critical thinking which encourages independent inquiry and problem-solving approaches in tackling challenging problems and scenarios.	Ap	M	Group Discussion/ Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**PROPERTIES OF MATTER & THERMODYNAMICS**				
Type of Course	**Minor (GROUP II: MATERIALS PHYSICS)**				
Semester	**I**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Awareness of Newton's first law, Hooke's law and static friction				
Course Summary	understanding of fundamental concepts of Equilibrium and Elasticity and their applications				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Understand the concept of the center of gravity and its significance in determining stability. Solve problems involving the equilibrium of rigid bodies subjected to various forces and torques. Apply principles of equilibrium to analyze real world scenarios. Get the concept of elastic moduli and their significance in characterizing material properties.	U	C	Instructor-created exams / Quiz
CO2	Understand density and pressure in a fluid and their effects in fluid behaviour. Explain the principle of buoyancy and its application in determining the behavior of floating and submerged objects. Understand Bernoulli's principle and its significance in describing the behaviour of fluids in motion. Analyse viscosity and turbulence.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Get the concepts of temperature and thermal equilibrium. Demonstrate a clear understanding of the first law of thermodynamics, including the principles of conservation of energy and the relationships between heat, work, and internal energy. analyze various thermodynamic processes, including the work done during volume changes and the paths between thermodynamic states.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Calculate and interpret the internal energy of ideal gases, understanding the heat capacities and behavior of ideal gases under different conditions, including adiabatic processes.	U	C	Instructor-created exams / Home Assignments
CO5	Grasp the significance of the second law of thermodynamics in determining the direction of thermodynamic processes. Analyze heat engines and refrigerators, applying the principles of the second law to evaluate their efficiency.	Ap	P	One Minute Reflection Writing assignments
CO6	understand fundamental concepts in thermodynamics and apply them in practical situations.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**MODERN PHYSICS AND NUCLEAR PHYSICS**				
Type of Course	**Minor (GROUP II: MATERIALS PHYSICS)**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1.Foundational understanding of classical physics, particularly in mechanics and electromagnetism. 2. Proficiency in algebra, calculus and trigonometry.				
Course Summary	This course explores the dual nature of particles and waves, as well as the structure and behavior of atomic and nuclear systems. Through theoretical discussions and practical applications, students will investigate electromagnetic waves, particle-wave duality phenomena, atomic structure, nuclear composition, and nuclear transformations.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the duality of particles and waves, Describe experimental evidence supporting the wave-particle duality, including the photoelectric effect and Compton effect.	U	C	Instructor-created exams / Quiz
CO2	Define pair production and its significance in quantum mechanics, Understand the concept of matter waves proposed by Louis de Broglie.	Ap	P	Seminar Presentation / Group Tutorial Work
CO3	Explain the structure of the atom according to the nuclear model, Understand Energy Levels and Spectra	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Investigate Nuclear Structure Understand stable nuclei, binding energy, and models such as the liquid drop model and shell model	U	C	Instructor-created exams / Home Assignments

CO5	Understand radioactive decay processes and their implications for nuclear stability,	Ap	P	One Minute Reflection Writing assignments
CO6	Analyse nuclear reactions, including fission and fusion, and their relevance in energy production and stellar evolution.	Ap	P	Writing assignments /Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**SOLID STATE PHYSICS AND SPECTROSCOPY**				
Type of Course	**Minor (GROUP II: MATERIALS PHYSICS)**				
Semester	**III**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge calculus, atomic theory and electromagnetic spectrum				
Course Summary	This course discusses the concepts of quantum mechanics, band theory and different types of spectroscopy at a fundamental level.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define quantum mechanics and its fundamental principles, explain the concept of quantization, understand the mathematical representation of wave functions and their interpretation. Application of Schrodinger equation for solving different physical systems.	Ap	P	Instructor-created exams / Quiz/Assignments
CO2	Understanding of Crystalline and Amorphous Solids and distinguishing between them. Understand the relationship between bonding and properties in different types of crystals	U	C	Instructor created Assignment/ Exams/Seminars
CO3	Explain band theory of solids and apply it in explaining the electronic structure of materials. Describe the formation of energy bands and band gaps in solids and their influence on material properties.	Ap	P	Seminar/Presentation / Group Tutorial Work

CO4	Explain the concept of quantization of energy and its importance in spectroscopy. Identify the types of molecular energies. Describe the process of absorption and emission of radiation and understand the Einstein coefficients governing these processes and their relation.	U	C	Instructor-created exams / Home assignments
CO5	Classify various spectroscopic methods used for sample analysis, like microwave spectroscopy, Infrared Spectroscopy, Electronic spectroscopy, Raman spectroscopy and analyse the possibility of applying these techniques to identify material properties.	An	P	One Minute Reflection Writing assignments and exams
CO6	Develop practical skills to perform spectra and material property related experiments and analyse characteristics of different spectra.	C	M	Practical Assignment/ Observation of Practical Skills / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**SEMICONDUCTOR PHYSICS AND ELECTRONICS**				
Type of Course	**Minor (GROUP III: SEMICONDUCTOR PHYSICS)**				
Semester	**I**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1.Basic understanding of physics and mathematics, including algebra and calculus. 2.Familiarity with fundamental concepts in electricity and magnetism.				
Course Summary	This course covers fundamental concepts in electronics, focusing on both theoretical understanding and practical applications. The syllabus includes topics such as atomic models, semiconductor physics, diode and transistor circuits, voltage stabilization, amplifiers, and digital electronics. The course aims to equip students with the necessary				

	knowledge and skills to analyze, design, and troubleshoot electronic circuits.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Master the energy band structure of semiconductors, differentiate between intrinsic and extrinsic semiconductors, grasp majority and minority carrier concepts, and proficiently analyse pn junctions.	U	F	Instructor-created exams / Quiz
CO2	Analyse diode rectifiers and filtering circuits, understand transistor basics and various configurations and load line analyse	An	C	Practical Assignment / Observation of Practical Skills
CO3	Gain insight into voltage stabilisation using Zener diodes. Design and understand the working of CE amplifiers. Get introduced to operational amplifiers.	C	P	Seminar Presentation / Group Tutorial Work
CO4	Understand Boolean algebra basics, the functioning of OR, AND, NOT gates, and the fundamental theorems. Master truth tables, symbolic representation, universal gates, XOR gates and adder circuits.	Ap	C	Instructor-created exams / Home Assignments
CO6	Practical session will help in understanding the working of pn junction diode, transistors. Will comprehend the working of logic gates in digital electronics	C	M	One Minute Reflection Writing assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge (F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**
Course Title	**FUNDAMENTALS OF OPTICS**
Type of Course	**Minor (GROUP III: SEMICONDUCTOR PHYSICS)**
Semester	**II**
Academic Level	**100 - 199**

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basics of Physics and Chemistry (Plus Two Level)				
Course Summary	This syllabus explores how light behaves, from reflection and bending to creating specific light sources and transmitting them through thin cables.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Analyze the principles of reflection and refraction, applying them to explain image formation by mirrors and lenses.	An	C	Instructor-created exams / Quiz/ Practical Assignment
CO2	Describe the phenomenon of wave interference and diffraction, and solve problems using concepts like the double-slit experiment.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Explain the concept of polarization and its applications, including the use of polarizers and analyzers.	U	C	Instructor-created exams / Quiz/ Practical Assignment
CO4	Describe the operating principles of lasers, including stimulated emission and population inversion, and identify different laser types.	U	C	Instructor-created exams / Home Assignments
CO5	Explain the concept of total internal reflection and apply it to understand light propagation through optical fibers.	Ap	F	Seminar Presentation / Group Tutorial Work
CO6	Able to explain the advantages and applications of optical fibers in communication and sensing.	U	C	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRONIC COMMUNICATION**				
Type of Course	**Minor (GROUP III: SEMICONDUCTOR PHYSICS)**				
Semester	**III**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Fundamentals of EM wave characteristics and electronics				
Course Summary	This course explores the characteristics of the EM wave spectrum, various communication systems and there implementation.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain main parts and different types of electronic communication system. Define electromagnetic spectrum and its application in communication systems.	Ap	P	Instructor-created exams / Home Assignments
CO2	Calculate voltage gain, current gain, attenuation. Explain relation between Q, resonant frequency and bandwidth.	Ap	P	Instructor-created exams / Home Assignments
CO3	Explain the basic concepts of AM and FM. Compare AM and FM and calculate parameters such as modulation index, band width.	An	P	Instructor-created exams / Home Assignments
CO4	Explain the fundamental concepts in digital communication such as quantizing error, analog to digital conversion, sampling, PAM, PWM, PPM, difference between asynchronous and synchronous data transmission.	U	C	Instructor-created exams / Home Assignments
CO5	Explain the reasons for the growing use of microwaves and millimetre waves in communications. Identify the microwave and millimetre-wave	An	P	Seminar Presentation / Group Tutorial Work

	band segments and various microwave components used in this communication system.			
CO6	Design and construct various circuit elements useful in communication systems. Design experiments to identify different characteristics of electromagnetic spectrum.	Ap	P	Practical Assignment / Observation of Practical Skills / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**ELECTRICITY AND MAGNETISM**				
Type of Course	**Minor (GROUP IV: OPTICAL PHYSICS)**				
Semester	**I**				
Academic Level	**100-199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	A strong foundation in introductory physics, including mechanics, thermodynamics, and basic concepts of electricity and magnetism. Proficiency in algebra, trigonometry				
Course Summary	This paper provides students with a solid foundation in the principles of electricity and magnetism, enabling them to apply theoretical concepts to practical scenarios and develop problem-solving skills in electromagnetism.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand and grasp the concept of electric charge, its properties, including quantization and conservation principles.	U	C	Instructor-created exams / Quiz

CO2	Students will analyze electric fields produced by various charge distributions, including point charges, electric dipoles, and charged infinite sheets. students will develop the ability to visualize electric fields and understand their behavior in different spatial configurations.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Understand the concept of electric dipoles, analyze the forces and torques acting on them in uniform electric fields, and relate these to practical applications.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Apply Gauss's law to calculate electric flux through closed surfaces, understand its implications for charge distribution, and analyze the behavior of electric fields in various scenarios.	U	C	Instructor-created exams / Home Assignments
CO5	calculate electric potential due to point charges, charged conductors, and other charge distributions, and analyze the concept of electric potential energy.	Ap	P	One Minute Reflection Writing assignments
CO6	Through practical experiments and theoretical analysis, students will explore applications of Gauss's law, such as determining charges on conductors and understanding electric potential distributions.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**OPTICS AND LASERS**				
Type of Course	**Minor (GROUP IV: OPTICAL PHYSICS)**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basics of Physics and Chemistry (Plus Two Level)				

Course Summary	This course explores light's properties, reflection, refraction, and applications in phenomena like interference, diffraction, polarization, and lasers.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the fundamental properties of light, including reflection, refraction, and the electromagnetic spectrum.	U	C	Instructor-created exams / Quiz
CO2	Apply the laws of reflection and refraction to solve problems involving mirrors and lenses.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Analyze the behavior of light waves using concepts like interference and diffraction.	An	C	Practical Assignment/ Seminar Presentation / Group Tutorial Work
CO4	Distinguish between Fresnel and Fraunhofer diffraction and explain how they affect light propagation.	An	C	Instructor-created exams / Home Assignments
CO5	Recognize different types of polarization and explain methods for producing and manipulating polarized light.	U	P	Instructor-created exams / Home Assignments
CO6	Apply the knowledge of optics and lasers to understand real-world applications in different fields.	E	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**
Course Title	**ATOMIC STRUCTURE AND SPECTROSCOPY**
Type of Course	**Minor (GROUP IV: OPTICAL PHYSICS)**
Semester	**III**
Academic Level	**200 - 299**

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic concepts related to optics, electromagnetism, wave mechanics, and electronics.				
Course Summary	This course provides a foundational understanding of quantum phenomena and spectroscopic methods. Students will explore topics such as electromagnetic waves, black body radiation, photoelectric effect, X-ray production, diffraction, De Broglie waves, atomic structure, and spectroscopy.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Studying electromagnetic waves, black body radiation, photoelectric effect, X-ray production, diffraction, and De Broglie waves.	U	C	Instructor-created exams / Quiz
CO2	Understands the dual nature of light and matter, leading to insights into quantum phenomena like particle confinement and uncertainty principles in position, momentum, energy, and time.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Understanding the nuclear atom model, electron orbits, and atomic spectra, including the Bohr atom's energy levels and line spectra,	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Elucidates the fundamental structure and behavior of atoms, offering insights into their spectral characteristics and origins.	U	C	Instructor-created exams / Home Assignments
CO5	Exploring spectroscopy introduces the electromagnetic spectrum's quantized energy, various molecular energies, and spectroscopic techniques, addressing spectral line width, absorption emission phenomena, EinstAssignmentein coefficients, and laser principles.	U	P	Practical skills/ Assignments
CO6	Important spectroscopic techniques used for sample analysis, like microwave spectroscopy, Infrared Spectroscopy, Electronic spectroscopy	U	P	Assignments/ Internal Exams

	and Raman spectroscopy are introduced			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**NON-CONVENTIONAL ENERGY SOURCES**				
Type of Course	**Minor (GROUP V: ENERGY PHYSICS)**				
Semester	**I**				
Academic Level	**100 - 109**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge of different forms of energy.				
Course Summary	This course provides a comprehensive introduction to various renewable energy resources with a focus on non-conventional sources. Students will explore the principles, technologies, advantages, disadvantages, and practical applications of solar, wind, geothermal, ocean, and biomass energy.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Develop a foundational understanding of energy resources, focusing on non-conventional sources such as solar energy, and grasp key terms and concepts including solar constant, radiation measurements, collectors, and practical applications of solar power.	U	C	Instructor-created exams / Quiz
CO2	Discover wind energy comprehensively, covering utilization, advantages, disadvantages, environmental impact, sources, conversion principles, components, pros and	Ap	P	Practical Assignment / Observation of Practical Skills

	cons, wind-electric power plants, economics, and operational challenges of large generators.			
CO3	Gain insight into geothermal energy, exploring Earth's interior structure, geothermal systems like hot springs and various resources, and understanding the advantages, disadvantages, and applications of geothermal energy in comparison to other forms.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Explore ocean energy, focusing on tidal and wave energy, understanding tidal power plant components, economic aspects, OTEC working principles, efficiency, types, and applications, considering advantages and disadvantages.	U	C	Instructor-created exams / Home Assignments
CO5	Understand biomass with its resources and conversion processes, explore biogas applications and plants	Ap	P	Writing assignments
CO6	Study fuel cells, hydrogen energy, government schemes, and subsidies, and conduct plant visits for performance analysis.	Ap	P	Seminar Presentation /Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**FLUID MECHANICS & THERMODYNAMICS**				
Type of Course	**Minor (GROUP V: ENERGY PHYSICS)**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1.Basic knowledge in units, vectors, pressure, work, mechanical energy and internal energy 2. Basic knowledge about specific heat and molar specific heat capacity				
Course Summary	Students will understand the behavior of fluids, including gas and liquid dynamics, density, pressure, buoyancy, fluid flow, and applications of Bernoulli's equation. Students will also understand the first and second laws of thermodynamics, including entropy, and analyze the directions of thermodynamic processes and will analyze the principles behind heat engines and refrigerators and solve numerical problems based on these topics.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fluid behavior, the properties of gasses and liquids dynamics including density and pressure in a fluid., buoyancy and fluid flow, applications of Bernoulli's equation.	U	C	Instructor-created exams / Quiz
CO2	Analyze Viscosity and Turbulence in fluids, identifying their effects on fluid behavior.	An	P	Practical Assignment / Observation of Practical Skills
CO3	Grasp the concepts of temperature and thermal equilibrium as well as thermal equilibrium and apply it to calculate the quantity of heat transferred in various processes.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Understand the first law of thermodynamics and Second law of thermodynamics, and entropy. Analyze the directions of thermodynamic processes and calculate the change in entropy indifferent thermodynamic processes	U	C	Instructor-created exams / Home Assignments

CO5	Analyze the principles behind Heat engines and Refrigerators and solve numerical problems based on these topics.	Ap	P	One Minute Reflection Writing assignments
CO6	Demonstrate comprehension of the second law of thermodynamics, including its application to the Carnot cycle.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**				
Course Title	**OPTICS AND SPECTROSCOPY**				
Type of Course	**Minor (GROUP V: ENERGY PHYSICS)**				
Semester	**III**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basics of Physics and Chemistry (Plus Two Level)				
Course Summary	This course explores the fundamental properties of light, its interaction with matter, and spectroscopic techniques used to analyze molecules.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the laws of reflection and refraction, and how they influence light behavior.	U	F	Instructor-created exams / Quiz
CO2	Describe the electromagnetic spectrum and differentiate between wave and particle properties of light.	U	C	Seminar Presentation / Group Tutorial Work
CO3	Analyze the principles of interference and apply them to phenomena like Young's double slit experiment.	An	P	Practical Assignment / Observation of Practical Skills
CO4	Explain the concept of polarization and apply it to phenomena like Brewster's Law.	Ap	P	Instructor-created exams / Home Assignments

CO5	Discuss the principles of optical activity and how it relates to specific rotation.	Ap	C	Practical Assignment / Observation of Practical Skills
CO6	Explain the fundamental concepts of spectroscopy, including energy quantization, absorption/emission, and different spectroscopic methods like microwave and infrared spectroscopy.	An	P	Instructor created exam/Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

VOCATIONAL MINOR COURSES

Programme	**B.Sc. Physics Honours**				
Course Title	**INTRODUCTORY MATERIALS SCIENCE**				
Type of Course	**Vocational Minor** **(GROUP I: TECHNIQUES IN MATERIALS PHYSICS)**				
Semester	**I**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basics of Physics and Chemistry (Higher Secondary Level)				
Course Summary	Explore the diverse world of materials and their properties through experimentation and analysis.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate a fundamental understanding of the different classes of materials (metals, ceramics, polymers, and composites) and their properties.	U	F	Instructor-created exams / Quiz
CO2	Apply electrical and magnetic property concepts to analyze and design materials for various applications.	Ap	C	Instructor-created exams / Quiz
CO3	Explain the interaction of light with materials and its impact on optical properties.	An	C	Seminar Presentation / Group Tutorial Work
CO4	Relate thermal properties of materials to their behaviour in different temperature environments.	An	C	Instructor-created exams / Home Assignments
CO5	Develop practical skills in using laboratory equipment to measure and characterize material properties.	An	P	Practical Assignment / Observation of Practical Skills

CO6	Analyze and interpret experimental data to draw meaningful conclusions.	An	P	Practical Assignment / Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**SYNTHESIS OF NANOMATERIALS**				
Type of Course	**Vocational Minor** **(GROUP I: TECHNIQUES IN MATERIALS PHYSICS)**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. PHY1VN101- Introductory Materials Science				
Course Summary	This course gives an introduction to the fascinating world of nanomaterials and diverse synthesis methods.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Define and classify nanomaterials and explain size-dependent properties.	U	F	Instructor-created exams / Quiz
CO2	Analyze various physical and chemical methods for nanomaterial synthesis, including their advantages, limitations, and applications.	An	C	Instructor-created exams / Home Assignments
CO3	Explain nanofabrication techniques: Grasp the concepts and applications of different nanolithography techniques like electron beam and photonic methods.	Ap	C	Seminar Presentation / Group Tutorial Work
CO4	Select appropriate synthesis methods: Analyze material requirements and choose suitable synthesis methods for specific applications.	Ap	P	Instructor-created exams / Home Assignments
CO5	Perform basic nanomaterial synthesis: Conduct laboratory experiments to prepare nanomaterials using different techniques learned.	E	P	Practical Assignment/ Observation of Practical Skills
CO6	Work collaboratively: Successfully participate in team-based projects and experiments related to nanomaterials.	E	P	Practical Assignment / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**
Course Title	**CHARACTERIZATIONS AND APPLICATIONS OF NANOMATERIALS (GROUP I: TECHNIQUES IN MATERIALS PHYSICS)**
Type of Course	**Vocational Minor**

Semester	**III**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. PHY1VN101- Introductory Materials Science 2. PHY3VN201- Characterizations and Applications of Nanomaterials				
Course Summary	Master the art of characterizing nanomaterials with microscopy, diffraction, and spectroscopy techniques, unlocking their secrets and exploring their diverse applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Describe various microscopic techniques: Understand the principles and applications of optical, confocal, SEM, TEM, SPM, STM, and AFM for nanomaterial characterization.	U	F	Instructor-created exams / Quiz
CO2	Explain diffraction principles: Grasp Bragg's law, crystal structure factors, and how X-ray diffraction (XRD) reveals nanomaterial structure.	Ap	C	Instructor-created exams / Home Assignments
CO3	Select appropriate characterization technique: Analyze nanomaterial properties and choose suitable techniques for specific information needs.	An	P	Seminar Presentation / Group Tutorial Work
CO4	Operate characterization instruments: Gain practical experience using microscopy, diffraction, and spectroscopy tools for data acquisition.	E	P	Practical Assignment / Observation of Practical Skills
CO5	Interpret characterization data: Analyze data from different techniques to extract information about size, morphology, structure, and composition.	E	P	Practical Assignment / Observation of Practical Skills
CO6	Communicate characterization results: Effectively present findings using figures, graphs, and scientific language in written and oral formats.	E	P	Seminar Presentation / Writing Assignment

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**SCIENTIFIC DOCUMENTATION**				
Type of Course	**Vocational Minor** **(GROUP I: TECHNIQUES IN MATERIALS PHYSICS)**				
Semester	**VIII**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Basic computer operating knowledge				
Course Summary	Master the art of characterizing nanomaterials with microscopy, diffraction, and spectroscopy techniques, unlocking their secrets and exploring their diverse applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Create professional-quality scientific documents, including research papers, reports, and theses, using LaTeX typesetting system.	Ap	P	Practical Assignment / Observation of Practical Skills
CO2	Develop proficiency in formatting and structuring scientific content effectively, adhering to established conventions and guidelines	Ap	P	Instructor-created exams / Home Assignments
CO3	Gain skills in incorporating complex mathematical equations, figures, and tables seamlessly into LaTeX documents to enhance clarity and understanding.	An	P	Practical Assignment / Observation of Practical Skills
CO4	Learn to manage citations and references efficiently using BibTeX or	An	P	Practical Assignment /

	BibLaTeX, ensuring accuracy and consistency in academic writing.			Observation of Practical Skills
CO5	Acquire techniques for designing and delivering engaging presentations and posters for scientific conferences and academic events using LaTeX Beamer class.	Ap	P	Seminar Presentation / Writing Assignment
CO6	Develop collaborative writing and version control skills, enabling them to work effectively with co-authors and collaborators on LaTeX documents for scientific communication and publication.	E	P	Seminar Presentation / Group Tutorial Work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**PYTHON BASICS**				
Type of Course	**Vocational Minor (GROUP II: DATA ANALYSIS IN PHYSICS)**				
Semester	**I**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic computer knowledge				
Course Summary	This course introduces Python programming for data analysis in Physics with the aid of machine learning. As the first step, Python language is introduced with emphasis on Numpy and matplotlib modules, for future use in machine learning.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used

CO1	Understand the significance of algorithm & flowchart in development of computer programs	U	F	Instructor-created exams
CO2	Understand and apply basic Python syntax	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO3	Understand and apply various conditional statements, as well as understand the modular nature of a program using functions in Python.	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO4	Apply various modules for several tasks in Python	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills/ Home Assignments
CO5	Understand in detail and apply the Numpy module in data analysis of physical data.	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO6	Understand and apply the matplotlib module for graphical representation of data in various pictorial formats.	C	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills/ Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	**B.Sc. Physics Honours**
Course Title	**DATA ANALYSIS IN PHYSICS USING PYTHON**
Type of Course	**Vocational Minor (GROUP II: DATA ANALYSIS IN PHYSICS)**
Semester	**II**
Academic Level	**100 - 199**

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY1VN102- Python Basics				
Course Summary	This paper continues from the previous paper for data analysis. More data analysis tools are introduced to be used in machine learning, as well as in physical data analysis. In addition, essential statistics required for data analysis is also introduced.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Become familiar with data format & programs used in data analysis	U	F	Practical Assignment / Observation of Practical Skills
CO2	Understand & apply Pandas module for data analysis	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO3	Understand & apply Seaborn module for data visualization	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO4	Understand the significance of statistical analyses as well as error analysis in physical measurements.	U	F	Instructor-created exams
CO5	Understand the significance of few distributions commonly found in physical measurements.	U	F	Instructor-created exams/ Home Assignments
CO6	Apply statistical methods to physical measurements	E	P	Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)				

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**DATA ANALYSIS IN PHYSICS USING MACHINE LEARNING**				
Type of Course	**Vocational Minor (GROUP II: DATA ANALYSIS IN PHYSICS)**				
Semester	**III**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of Programming Concepts 2. PHY1VN102- Python Basics 3. PHY2VN102- Data Analysis in Physics Using Python				
Course Summary	This course explores Machine Learning fundamentals: types, challenges, and model training techniques like Linear Regression, Gradient Descent, KNN, and clustering. Analyze data using Scikit-learn, handle classification problems with performance evaluation measures on real datasets.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Grasp the concepts and importance of Machine Learning, its types, and real-world problem-solving applications.	U	C	Instructor-created exams / Quiz
CO2	Understand linear regression, model evaluation metrics, and various types of regression. They will apply this knowledge practically using examples.	Ap	P	Practical Assignment / Observation of Practical Skills

CO3	Master in K-Nearest Neighbor classification, decision trees, entropy, Gini index, and K-means clustering, demonstrated through practical applications with sample datasets.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Apply classification algorithms to MNIST data, including binary classifiers and multilabel classification, and interpret performance measures like confusion matrix, precision, recall, and ROC curve	U	C	Instructor-created exams / Home Assignments
CO5	Learn to implement and construct a ML model for one of the problems mentioned.	Ap	P	One Minute Reflection Writing assignments/ Vice Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**APPLICATIONS OF ADVANCED MACHINE LEARNING & ARTIFICIAL INTELLIGENCE IN PHYSICS**				
Type of Course	**Vocational Minor (GROUP II: DATA ANALYSIS IN PHYSICS)**				
Semester	**VIII**				
Academic Level	**300 – 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. PHY1VN102- Python Basics 2. PHY2VN102- Data Analysis in Physics Using Python 3. PHY3VN202- Data Analysis in Physics Using Machine Learning				

Course Summary	This course explores the fundamentals of Artificial Intelligence: Basic idea about AI. It also explains the advanced concepts of Machine Learning Techniques. Deep Learning and CNNs are introduced.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Acquire expertise in DBSCAN for spatial clustering and neural networks for comprehensive data analysis and pattern recognition proficiency.	Ap	P	Practical Assignment / Observation of Practical Skills
CO2	Grasp the significance of SVM, apply it using Python, adjust parameters, evaluate pros/cons, and employ it across varied applications.	U	C	Instructor-created exams / Quiz
CO3	Understand the Deep Learning concepts, utilise the TensorFlow/Keras framework, grasp neural network variants, and understand various neural network architectures.	U	C	Seminar Presentation / Group Tutorial Work
CO4	Develop machine learning models for practical applications, enhancing skills in classification, feature selection, and model evaluation techniques.	Ap	P	Instructor-created exams / Home Assignments
CO5	Grasp the concepts and importance of Artificial Intelligence, historical context and how the brain processes information.	U	C	One Minute Reflection Writing assignments

* - Remember I, Understand (U), Apply (Ap), Analyse (An), Evaluate I, Create I

- Factual Knowledge(F) Conceptual Knowledge I Procedural Knowledge (P) Metacognitive Knowledge (M)

GENERAL FOUNDATION COURSES

Programme	**B.Sc. Physics Honours**				
Course Title	**PHYSICS IN DAILY LIFE**				
Type of Course	**Multi-Disciplinary Course 1**				
Semester	**I**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	High school level science				
Course Summary	This course explores the use of physics in daily life. Working of the daily use devices, physical principles coming to play in the kitchen and in sports are explored.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply the principles of physics to several day-to-day phenomena in the kitchen.	Ap	F	Instructor-created exams / Quiz
CO2	Understand the working of common kitchen appliances, as well as the usage of several types of materials as kitchen utensils.	U	F	Instructor-created exams / Quiz
CO3	Apply the principles of physics to the sport of cricket.	Ap	F	Instructor-created exams / Quiz

CO4	Apply the principles of physics to the sport of football.	Ap	F	Instructor-created exams / Quiz
CO5	Understand the connection between resonance and sound phenomena.	U	F	Instructor-created exams / Quiz
CO6	Understand the working of common appliances like photostat machine, air conditioner etc.	Ap	F	Instructor-created exams / Quiz

* - Remember I, Understand (U), Apply (Ap), Analyse (An), Evaluate I, Create I

- Factual Knowledge(F) Conceptual Knowledge I Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours**				
Course Title	**ASTRONOMY AND STARGAZING**				
Type of Course	**Multi-Disciplinary Course 2**				
Semester	**II**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	High school level science				
Course Summary	This introductory course in amateur astronomy provides students with a foundational understanding of observational astronomy, celestial objects and basic techniques for amateur stargazing. Through a combination of lectures, classroom demonstrations and field observations, students will gain practical skills and theoretical knowledge to explore the wonders of the night sky.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the development of astronomical knowledge from the ancient models to the modern astronomical theories.	U	C	Instructor-created exams / Quiz
CO2	Understand the scientific principles underlying astronomical observations and the characteristics and properties of celestial objects	U	C	Instructor-created exams / Quiz
CO3	Apply observational techniques and methods to effectively navigate the night sky.	Ap	P	Observational Home Assignment / Viva Voce
CO4	Analyze astronomical phenomena such as phases of the moon, alignments of constellations and planets.	An	P	Demonstration Skills / Viva Voce
CO5	Foster an interest in citizen science and amateur contributions to astronomy.	An	P	Instructor-created Home Assignments
CO6	Develop a scientific temper, curiosity and a sense of wonder about the universe	Ap	P	Instructor-created Home Assignments

* - Remember I, Understand (U), Apply (Ap), Analyse (An), Evaluate I, Create I

\# - Factual Knowledge(F) Conceptual Knowledge I Procedural Knowledge (P) Metacognitive Knowledge (M)

IMPORTANT: This course is for the Double Major pathway only.

Programme	**B.Sc. Physics Honours**				
Course Title	**RENEWABLE ENERGY SOURCES**				
Type of Course	**Value-Added Course 1**				
Semester	**III**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	0	45
Pre-requisites	Basic knowledge of different forms of energy.				
Course Summary	This course provides a comprehensive introduction to various renewable energy resources with a focus on non-conventional sources. Students will explore the principles, technologies, advantages, disadvantages, and practical applications of solar, wind, geothermal, ocean, and biomass energy.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Develop a foundational understanding of energy resources, focusing on non-conventional sources such as solar energy, and grasp key terms and concepts including solar constant, radiation measurements, collectors, and practical applications of solar power.	U	C	Instructor-created exams / Quiz
CO2	Discover wind energy comprehensively, covering utilization, advantages,	Ap	P	Practical Assignment /

	disadvantages, environmental impact, sources, conversion principles, components, pros and cons, wind-electric power plants, economics, and operational challenges of large generators.			Observation of Practical Skills
CO3	Gain insight into geothermal energy, exploring Earth's interior structure, geothermal systems like hot springs and various resources, and understanding the advantages, disadvantages, and applications of geothermal energy in comparison to other forms.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Explore ocean energy, focusing on tidal and wave energy, understanding tidal power plant components, economic aspects, OTEC working principles, efficiency, types, and applications, considering advantages and disadvantages.	U	C	Instructor-created exams / Home Assignments
CO5	Understand biomass with its resources and conversion processes, explore biogas applications and plants	Ap	P	Writing assignments
CO6	Study fuel cells, hydrogen energy, government schemes, and subsidies, and conduct plant visits for performance analysis.	Ap	P	Seminar Presentation /Viva Voce
* - Remember I, Understand (U), Apply (Ap), Analyse (An), Evaluate I, Create I # - Factual Knowledge(F) Conceptual Knowledge I Procedural Knowledge (P) Metacognitive Knowledge (M)				

IMPORTANT: This course is for the Double Major pathway only.

Programme	**B.Sc. Physics Honours**				
Course Title	**SCIENCE COMMUNICATION**				
Type of Course	**Value-Added Course 2**				
Semester	**IV**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic computer operating knowledge.				
Course Summary	This course introduces Latex programming for preparing scientific documents and presentations. This paper also introduces formal science communication, of which presentation and document writing forms a part.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Learn the basic structure of a LaTeX document, creating a new latex document	U	F	Instructor-created exams / Quiz / Practical Assignment
CO2	Understanding how to split a document into logical parts.	U	F	Instructor-created exams / Quiz / Practical Assignment
CO3	Understand text and paragraph formatting in	U	F	Instructor-created exams / Quiz / Practical Assignment

	Latex, including insertion of numbered and bulleted lists.			
CO4	Understand how to insert tables, pictures, table of contents and equations in latex document.	U	F	Instructor-created exams / Quiz / Practical Assignment
CO5	Understand how to prepare a presentation using Latex.	Ap	F	Instructor-created exams / Quiz / Practical Assignment
CO6	Acquire the skillset required for formal science communication, including knowledge about journals, presentation skills and time management.	U	C	Instructor-created exams / Quiz
* - Remember I, Understand (U), Apply (Ap), Analyse (An), Evaluate I, Create I # - Factual Knowledge(F) Conceptual Knowledge I Procedural Knowledge (P) Metacognitive Knowledge (M)				

SEC2 consists of 2 hrs. of lecture / tutorial classes and 1 hr. of demonstration/ practical classes per week.

Evaluation: Considering the nature of the SEC2 course, the internal evaluation for the 25 marks, including the 5 marks in the open ended module, will be entirely based on the practical examination and viva.

Programme	**B.Sc. Physics Honours**				
Course Title	**PYTHON FOR DATA ANALYSIS**				
Type of Course	**Skill Enhancement Course 2**				
Semester	**V**				
Academic Level	**100-199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	2	-	1	45
Pre-requisites	1. Fundamentals of Programming Concepts				

Course Summary	This course explores the fundamental concepts of algorithms, control statements, functions, Numpy arrays, Matplotlib, and Seaborn for data visualization and practical application.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate Python for data analysis, including numerical operations, file handling, control flow, functions, and NumPy arrays.	U	C	Instructor-created exams / Quiz
CO2	Understand and master Pandas functionalities for data manipulation, sorting, handling missing data, statistical analysis, time series operations, and data merging/concatenation techniques in Python.	Ap	P	Instructor-created exams / Home Assignments
CO3	Master the visualisation tools in Pandas and Seaborn libraries using physics data. Draw various plots, interpret findings, and utilise the Seaborn library for advanced visualisation techniques.	Ap	P	Seminar Presentation/ Group Tutorial Work
CO4	Understand the various data file formats and learn to read and handle data files in Jupyter Notebooks, including CSV, XLS, TAB, and DAT formats.	U	C	Instructor-created exams / Home Assignments
CO5	Demonstrate problem-solving skills to solve practical physics problems by creating programs for real data analysis and utilise the different functionalities available in Pandas and Seaborn Python Packages.	Ap	P	One Minute Reflection Writing assignments/ Viva Voce
CO6	Develop skills in data manipulation and analysis using the pandas library, including dataframe creation, data wrangling, descriptive statistics, and visualization techniques using matplotlib and seaborn	Ap	P	Practical Assignment / Observation of Practical Skills

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge Metacognitive Knowledge (M)

Programme	**B.Sc. Physics Honours page**

Course Title	**ELECTRICAL AND PHOTOVOLTAIC DEVICES**				
Type of Course	**Skill Enhancement Course 3**				
Semester	**V**				
Academic Level	**100 – 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basics of electromagnetism and electronics.				
Course Summary	This course explores the working of various electrical, photovoltaic and storage devices.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand and analyse the working of a DC motor.	An	P	Instructor-created exams / Home Assignments
CO2	Identify different electrical elements used in house wiring and demonstrate the working of these elements.	Ap	P	Instructor-created exams / Home Assignments
CO3	Explain various conventional and non-conventional power generation techniques and discuss the possibility of using these techniques in your state.	U	P	Instructor-created exams / Home Assignments
CO4	Analyse and determine the basic characteristics of Photovoltaic Cell. Design a model unit.	An	C	Instructor-created exams / Home Assignments
CO5	Explain the scope of different battery technologies and analyse the technical complexity to design the same.	Ap	P	Seminar Presentation / Group Tutorial Work
CO6	Generate skill to wind motors, wiring a home, develop storage devices.	C	P	Practical Assignment / Observation of Practical Skills / Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)