PHYSICS (This is a template to implement OBE)

<B.Sc.>

Instructions: Total document to be prepared in Times New Roman font. The Heading should be Bold and font size 14, the Second heading (sub-heading) should be bold and size 12, and the body text should be 12 font size with single line spacing.

VISION

<Write the department vision statement in 3 bullet points>

- To build a foundation for excellence in research, teaching, innovation and entrepreneurship
- Strive towards the growth and development of the Institution to transform it into a premier Institution by igniting and promoting enthusiasm, curiosity and passion, towards the study of physics at various levels
- Create a scientific society that encourages rational behaviour, logical reasoning and interdisciplinary research.

MISSION

<Write the department's mission statement in 3 bullet points>

- To ignite young minds and discover their talents both in theoretical and experimental Physics, through constantly upgraded state of the art academic programmes in Physics and allied interdisciplinary subjects, commitment towards students and interactive and innovative instructional methods of student centric teaching. To create state of the art research laboratories for internal as well as external students from other academic institutions. To support the developmental activities of the University and make the Department vibrant through scientific camps, open-house, workshops etc.
- To make vital contributions to the society through creation of modern laboratory facilities, motivated faculties enriched through faculty development programs who would contribute towards achieving high level of competence in the study of Physics. To develop a strategy for continuous evolution and upgradation of the Department at par with the latest developments in the field of science and technology.
- To create intellectual property through innovations, quality research publications and patents. To produce graduates who are globally acceptable professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service, corporate organizations along with skills for entrepreneurial pursuits in multidisciplinary areas.

<Vision/Mission both must have 3 bullets across all the programs offered by the University>

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To enable the graduates to pursue higher education in physics and allied domains and to produce graduates with ability to work both independently and in a group.

PEO2: To impart procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service. To produce graduates who are globally acceptable professionals for corporate organizations along with skills for entrepreneurial pursuits in multidisciplinary areas.

PEO3: To engage graduates in professional pursuits to enhance their own achievements along with serving the society at large.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1: The students will realize the vast scope of Physics as a theoretical and experimental science with applications in solving most of the problems in nature spanning from 10^{-15} m to 10^{26} m in space and 10^{-10} eV to 10^{25}eV in energy dimensions. They will be able to interpret fundamental and advanced knowledge in Physics and their applications in different subfields like Mathematical Physics, Classical and Quantum mechanics, Thermal and Statistical mechanics, Electricity, Magnetism and Electromagnetic theory, solid state physics, Nuclear and Particle Physics and other related fields of study, including broader interdisciplinary areas like electronics, materials science, nanotechnology, astrophysics, energy research, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology etc.

PSO2: Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics. Use computational and mathematical tools to model physical systems, simulate experiments, and analyze complex data.

PSO3: Utilise a variety of physics concepts to solve science, social science, and technology-related real life problems.

PROGRAMME OUTCOMES:

<It is mandatory to use 11 POs for Engineering and MCA, for other programmes, please restrict to 8.

PO1: Disciplinary knowledge and skills- The students will be able to demonstrate good knowledge and understanding of major concepts, theoretical principles and experimental findings. The students should be able to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable in almost all the fields of Physic

PO2: Skilled communicator- The students will develop skills to transmit complex technical information in a clear and concise manner in written, oral and graphical forms to both scientific and non-scientific audiences.

PO3: Critical thinker and problem solver- The students will be able to employ critical thinking and efficient problem-solving skills

PO4: Sense of inquiry- The students will be able to identify relevant questions relating to the issues and problems in the field of Science, as well as effectively plan, execute and report the results of a theoretical or experimental investigation.

PO5: Team work and project management - The students will build capacity to work effectively in diverse teams in both classroom, research laboratory and field-based situations, as well as in any organization. They will be able to identify/mobilize appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.

PO6: Digital Efficiency and usage of modern tools- The students will be able to apply appropriate computational and technological tools (e.g., programming, simulations, data analysis software) for solving problems, employ modern e-library search tools and use various websites to locate, retrieve, and evaluate relevant information.

PO7: Ethical awareness - The graduate will demonstrate ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, avoid unethical behavior in scientific practices and professional activities.

PO8: Lifelong learners- The students will be capable of self-paced and self-motivated learning for improving knowledge/skill development and reskilling to keep pace with advancements

Credit Definition

Type	Duration (in hours)	Credit
Lecture (L)	1	1
Tutorial (T)	1	1
Practical (P)	2	1

Total Credit Distribution for the Entire Programme

Semester	Credits										Credits/Semester
	MC	ME	Project	NM	NV	MDC	AEC	SEC	VAC	INT	
1	8	0	0	4	2	0	2	3	2	0	21
2	8	0	0	0	2	4	2	3	2	0	21
3	10	0	0	4	2	4	2	0	0	0	22
4	10	0	0	4	2	4	2	0	0	0	22
5	14	0	0	0	2	0	0	3	2	0	21
6	12	0	0	4	2	0	0	0	0	3	21
7	16	0	0	4	0	0	0	0	0	0	20
8	0	8/20	12/0	0	0	0	0	0	0	0	20
Credits/Course	**78**	**8/20**	**12/0**	**20**	**12**	**12**	**8**	**9**	**6**	**3**	**168**

Category Definition

Definition of Category/Type	Abbreviation
Major Compulsory	**MC**
Major Elective	**ME**
Non-Major Specific Subject Course	**NM**
Non-major Vocational Education and Training	**NV**
Multidisciplinary Courses	**MDC**
Ability Enhancement Courses	**AEC**
Skill Enhancement Courses	**SEC**
Value Added Courses	**VAC**
Internship	**INT**

FIRST YEAR

SEMESTER-I

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1.	Classical Mechanics		MC 1	4	3	0	1
2.	Mathematical Methods		MC2	4	4	0	0
3.	Analytical Techniques of Physics		NM1	4	4	0	0
4.	Vocational-EAAI(Yoga/Sports/NCC/NSS)		NV1	1	0	0	1
5.	Vocational– Soft Skill Development I		NV2	1	1	0	0
6.	Communicative English I		AEC1	2	2	0	0
7.	Environmental Science I		VAC1	2	2	0	0
8.	Computer Application		SEC1	3	3	0	0
Total Credits				21 Credits			

SEMESTER-II

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Electrodynamics-I		MC3	4	3	0	1
2	Wave and Optics		MC4	4	3	0	1
3	Vocational-EAAII(Yoga/Sports/NCC/NSS)		NV3	1	0	0	1
4	Vocational–Soft Skill Development II		NV4	1	1	0	0
5	Selected by the candidate (Elective)		MDC 1	4	4	0	0
6	Communicative English II		AEC2	2	2	0	0
7	Environmental Science II		VAC 2	2	2	0	0
8	Computer Application II		SEC2	3	3	0	0
Total Credits				21 Credits			

SECOND YEAR

SEMESTER-III (Sample)

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Heat and Thermodynamics		MC5	4	3	0	1
2	Basic Quantum Mechanics		MC6	3	3	0	0
3	Statistical Mechanics		MC7	3	3	0	0
4	Vocational-Mentored Seminar I		NV5	1	1	0	0
5	Vocational–Soft Skill Development III		NV6	1	1	0	0
6	Selected by the candidate		NM2	4	4	0	0
7	Selected by the candidate(Elective)		MDC2	4	4	0	0
8	Logical Ability I/Foreign Language I		AEC3	2	2	0	0
Total Credits				22 Credits			

SEMESTER-IV (Sample)

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Basic Electronics		MC8	5	4	0	1
2	Special Theory of Relativity		MC9	2	2	0	0
3	Advance Quantum Mechanics		MC10	3	3	0	0
4	Vocational-Mentored Seminar II		NV7	1	1	0	0
5	Vocational–Soft Skill Development IV		NV8	1	1	0	0
6	Selected by the candidate (Elective)		MDC3	4	4	0	0
7	Logical Ability II/Foreign Language II		AEC4	2	2	0	0
8	Selected by the candidate		NM3	4	4	0	0
Total Credits				22 Credits			

THIRD YEAR

SEMESTER-V (Sample)

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Solid State Physics		MC11	5	4	0	1
2	Electrodynamics-II		MC12	5	4	0	1
3	Electrical Technology		MC13	4	3	0	1
4	Vocational-Mentored Seminar III		NV9	1	1	0	0
5	Vocational–Soft Skill Development V		NV10	1	1	0	0
6	Selected by the candidate		SEC3	3	3	0	0
7	Ethics Study and IPR		VAC3	2	2	0	0
Total Credits				21 Credits			

SEMESTER-VI (Sample)

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Atomic, Molecular and Laser Physics		MC14	4	4	0	0
2	Solid State Devices		MC15	4	4	0	0
3	Material Science & Nanotechnology		MC16	4	4	0	0
4	Vocational-Mentored Seminar IV		NV11	1	1	0	0
5	Vocational–Soft Skill Development VI		NV12	1	1	0	0
6	Selected by the candidate		NM4	4	4	0	0
7	Internship		INT1	3	0	0	3
Total Credits				21 Credits			

FOURTH YEAR

SEMESTER-VII (Sample)

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Astrophysics & Space Sciences		MC17	4	4	0	0
2	Spectroscopic Techniques		MC18	4	4	0	0
3	Elective - Quantum Computation/QFT		MC19	4	4	0	0
4	Medical Physics		MC20	4	4	0	0
5	Selected by the candidate		NM5	4	4	0	0
Total Credits				20 Credits			

SEMESTER-VIII (Sample)

Sl No	Course Title	Code	Type	Credit	Type		
					L	T	P
1	Acoustics & Sound Engineering		MC21	4	4	0	0
2	Computational Physics		MC22	4	4	0	0
3	Project/(Plasma Physics, GTR, Condensed Matter Physics)		ME Project/ Courses	12/ (4+4+4)	0/9	0	12/3
Total Credits				22 Credits			

COURSE CO-PO-PSO MAPPING

SEMESTER-I

COURSE 1 (MC1: Classical Mechanics; Component: Theory)

COURSE OUTCOMES:

CO1: Explain the basic concepts of classical mechanics and distinguish frames of reference

CO2: Compare the phenomena of elastic and inelastic collision between particles.

CO3: Apply the knowledge of Newton's laws of mechanics on non-inertial frame and illustrate the dynamics of rotating objects

CO4: Explain motion of a particle under central force field and relate with real world problems

CO5: Formulate Lagrangian and Hamiltonian to solve equations of motion for various problems

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	1	2	3	1	1
CO2	2	2	3	2	1	1	1	2	2	1	3
CO3	3	1	3	2	1	2	1	2	2	3	2
CO4	3	2	3	2	1	1	1	2	2	1	3
CO5	3	1	3	2	1	3	1	2	3	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 1 (MC1: Classical Mechanics; Component: Practical)

COURSE OUTCOMES:

CO1. Examine the motion of spring and calculate Spring constant.

CO2. Detect moment of inertia of flywheel

CO3. Apply flexure Method to determine Young's Modulus of a rod

CO4. Apply statical method to determine the Modulus of Rigidity of a wire

CO5. Generate value of acceleration due to gravity using bar pendulum and simple pendulum.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	1	2	3	1	1
CO2	2	2	3	2	1	1	1	2	2	1	3
CO3	3	1	3	2	1	2	1	2	2	3	2
CO4	3	2	3	2	1	1	1	2	2	1	3
CO5	3	1	3	2	1	3	1	2	3	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC2: Mathematical Methods (Credit 4))

COURSE OUTCOMES:

CO1: Classify different vector operators in Cartesian coordinates and discuss the applications of vector integration.

CO2: Implement vector differentiation in the orthogonal curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.

CO3: Examine linear independence in vector space.

CO4: Critique the properties of eigenvalues and eigenvectors in relation to matrix diagonalization and orthonormality.

CO5: Formulate analytic functions and construct examples relevant to physical applications.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	1
CO2	3	1	3	2	1	2	1	2	3	2	2
CO3	3	1	3	2	1	1	1	2	3	1	2
CO4	3	1	3	2	1	1	1	2	3	1	3
CO5	3	1	3	2	1	1	1	3	3	1	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (NM1: Analytical Techniques of Physics)

COURSE OUTCOMES:

CO1: Formulate solutions of ordinary and partial differential equations using analytical techniques.

CO2: Implement beta, gamma function to solve improper integrals.

CO3: Examine second order differential equations with variable coefficients.

CO4: Identify and describe integral transforms.

CO5: Check periodicity of functions and reconstruct the Fourier series for those functions.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	3	2	1	2	0	2	3	3	2
CO2	3	1	3	2	1	2	0	2	3	3	2
CO3	3	1	3	2	1	2	0	2	3	3	2
CO4	3	1	3	2	1	3	0	2	3	3	2
CO5	3	1	3	2	1	2	0	2	3	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

SEMESTER-II

COURSE 1 (MC3: Electrodynamics (Credit 3+1); Component : Theory (Credit 3))

COURSE OUTCOMES:

CO1: Explain the concepts of electric field, electric potential, Gauss' law, polarization, magnetization, and electromagnetic induction, and **describe** how these principles govern the behavior of electric and magnetic fields in matter.

CO2: Apply Gauss' Law, Biot–Savart Law, Ampere's Law, and Faraday's Law to **compute** electric fields, magnetic fields, induced EMF, capacitance, inductance, and energy stored in electric and magnetic systems for symmetric charge and current distributions.

CO3: Analyze the behavior of conductors, dielectrics, magnetic materials, and current loops under the influence of electric and magnetic fields, and **differentiate** between linear, paramagnetic, diamagnetic, and ferromagnetic responses.

CO4 : Evaluate the electrostatic and magnetostatic energy in charge and current configurations, including dipoles and inductive systems, and **justify** the effectiveness of methods such as the method of images for solving boundary value problems.

CO5 : Formulate solutions using Laplace's and Poisson's equations and **develop** conceptual models based on Maxwell's equations to describe the dynamic interdependence of electric and magnetic fields.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	1
CO2	3	1	3	2	1	2	1	2	3	2	1
CO3	3	1	3	3	1	2	1	2	3	2	2
CO4	3	1	3	3	1	2	1	2	3	2	2
CO5	3	2	3	3	1	3	1	2	3	2	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 1 (MC3: Electrodynamics (Credit 3+1); Component : Practical (Credit 1))

COURSE OUTCOMES:

CO1: Identify and describe the functions, operating principles, and measurement ranges of multimeters, bridges, potentiometers, and solenoids used in basic electrical measurements.

CO2 : Use a digital/analog multimeter and standard bridge circuits to **measure** resistance, capacitance, current, and voltage in different electrical setups with proper handling and safety practices.

CO3 : Analyze the behavior of RC circuits and **interpret** their charging and discharging characteristics through experimental data and graphical representation.

CO4: Evaluate the accuracy and reliability of measured values of low resistances and capacitances by **comparing** different measurement methods such as Potentiometer, Carey Foster's Bridge, and De'Sauty's Bridge.

CO5: Design and perform experiments to **determine** the spatial variation of magnetic field strength in a solenoid and **prepare** a clear report summarizing observations, calculations, and sources of experimental error.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	2	1	2	2	2	1
CO2	3	1	2	2	1	3	1	2	2	3	2
CO3	2	1	3	2	1	3	1	2	2	3	2
CO4	2	1	3	3	1	2	1	2	2	3	2
CO5	2	3	2	3	2	2	1	2	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC4: Wave & Optics (Credit 3+1) Component : Theory (Credit 3))

COURSE OUTCOMES:

CO1 : Explain the characteristics of simple, damped, and forced oscillations, resonance, and energy distribution in wave motion.

CO2 : Implement the principles of superposition to demonstrate stationary and progressive waves, phase and group velocities, and normal modes in strings and pipes.

CO3: Differentiate between Fresnel and Fraunhofer diffraction and analyze their patterns for various apertures.

CO4 : Evaluate the resolving power of optical instruments using diffraction and interference principles.

CO5 : Design optical arrangements based on interference and diffraction methods for determining wavelength and refractive index.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	1	1	2	3	1	1
CO2	3	1	2	2	1	2	1	2	3	2	2
CO3	3	1	3	2	1	2	1	2	3	2	2
CO4	3	1	3	3	1	2	1	2	3	2	2
CO5	3	3	2	3	2	2	1	2	3	3	3

COURSE 2 (MC4: Wave & Optics (Credit 3+1) Component : Practical (Credit 1))

COURSE OUTCOMES:

CO1: Describe the principles of mechanical and optical oscillations through experimental observation.

CO2: Demonstrate the formation of stationary and progressive waves using different experimental setups.

CO3: Differentiate various diffraction patterns and interpret the conditions affecting their formation.

CO4: Appraise the performance and resolving power of optical instruments through precise measurements.

CO5: Construct and align optical arrangements to determine wavelength, refractive index, and related optical parameters.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	2	1
CO2	3	2	2	3	2	2	1	2	2	3	2
CO3	3	1	3	2	1	2	1	2	3	2	2
CO4	3	2	3	3	2	2	1	2	3	3	2
CO5	2	2	3	3	3	3	1	2	2	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

SEMESTER-III

COURSE 1 (MC5: Heat and Thermodynamics; Component : Theory)

COURSE OUTCOMES:

CO1: **Explain** the foundational principles of **thermal physics and thermodynamics.**

CO2: **Analyse** the behaviour of real gases.

CO3: **Solve** problems related to the conduction of heat.

CO4: **Evaluate** the first and second laws of thermodynamics in various thermodynamic systems.

CO5: **Formulate** expressions for thermodynamic potentials.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	1	0	1	1	2	3	1	1
CO2	2	1	3	2	0	2	1	2	3	1	2
CO3	2	1	3	2	1	3	1	2	2	3	2
CO4	3	1	3	3	1	2	1	2	3	2	2
CO5	3	1	3	2	1	2	1	2	3	2	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 1 (MC5: Heat and Thermodynamics; Component : Practical)

COURSE OUTCOMES:

CO1: **Demonstrate** experimental skill in determining the mechanical equivalent of heat (J) using Callender and Barnes' constant flow method.

CO2: Measure and compare the thermal conductivity of good and bad conductors using Searle's, Angstrom's**,** and Lee's disc methods.

CO3: **Examine** the temperature coefficient of resistance of metals using a Platinum Resistance Thermometer (PRT).

CO4: **Interpret** the thermo-emf behavior of a thermocouple as a function of temperature difference.

CO5: **Monitor** thermocouple-based temperature measurement system using null method and Op-Amp differential amplifier.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	1	2	2	1	3	1	2	2	3	1
CO2	2	1	3	3	1	3	1	2	3	3	2
CO3	2	1	3	3	1	3	1	2	3	3	2
CO4	2	1	2	2	1	3	1	2	2	3	2
CO5	2	1	3	2	1	3	1	2	2	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC6: Basic Quantum Mechanics)

COURSE OUTCOMES:

CO1: Explain the limitations of classical theory and basic principles of quantum mechanics.

CO2: Apply the time-dependent and time-independent Schrödinger equations to analyze different physical situations.

CO3: Differentiate between various one-dimensional potential problems and analyze their transmission and reflection characteristics.

CO4: Evaluate the solutions of the linear harmonic oscillator and verify uncertainty principle to obtain the idea of zero-point energy.

CO5: Formulate quantum-mechanical models by constructing wave functions for simple physical systems and interpreting their physical significance.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	0	1	1	2	3	1	1
CO2	2	0	3	2	0	3	0	1	3	3	1
CO3	3	1	3	1	0	2	0	1	3	3	1
CO4	2	1	3	3	0	1	1	1	3	3	1
CO5	2	3	3	1	1	2	1	2	3	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (MC7: Statistical Mechanics)

COURSE OUTCOMES:

CO1: Explain the foundational concepts of classical statistics

CO2: Interpret key laws of statistical mechanics

CO3: Examine the thermodynamic behavior of photon gases and degenerate Bose gases and analyze phenomena such as Bose-Einstein condensation and radiation as photon gas.

CO4: Verify the predictions of Fermi-Dirac statistics through the study of various systems

CO5: Generate classical entropy expressions and statistical models using partition functions

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	0	1	1	2	3	1	1
CO2	3	2	2	1	0	1	1	2	3	2	1
CO3	3	1	3	2	0	3	1	1	3	3	3
CO4	2	1	3	3	0	2	1	1	3	3	2
CO5	2	1	3	1	0	3	1	2	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

SEMESTER-IV

COURSE 1 (MC8: Basic Electronics ; Component : Theory)

COURSE OUTCOMES:

CO1 : Explain the electronic properties of semiconductors, PN junction behavior, diode characteristics, transistor configurations, FET operation, and operational amplifier parameters, along with digital logic fundamentals and number systems.

CO2 : Apply the principles of diode and transistor operation to **construct and analyze** rectifiers, voltage regulators, biasing circuits, and transistor amplifier stages using h-parameter models and op-amp configurations for signal processing tasks.

CO3 : Analyze the input-output characteristics of BJT and FET devices, **distinguish** operating regions, and **interpret** the stability of biasing circuits, feedback effects, switching behaviors, and waveform responses in analog and digital circuits.

CO4 : Evaluate the performance of analog and digital circuits by **calculating** efficiency, ripple factor, gain, frequency response, CMRR, and logical simplifications using Boolean algebra and Karnaugh maps, and **assess** the suitability of IC technologies and device choices in circuit design.

CO5 : Design and implement analog and digital circuit systems—including amplifiers, operational amplifier applications, logic circuits, counters, and registers—and **develop** functional solutions to real-world signal conditioning and digital processing problems.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1	0	3	1	1	3	1	0
CO2	3	1	2	1	1	3	0	1	2	3	1
CO3	3	1	3	2	0	2	1	1	3	2	1
CO4	3	1	3	3	1	2	1	1	2	2	2
CO5	3	1	3	1	3	3	1	2	2	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 1 (MC8: Basic Electronics ; Component : Practical)

COURSE OUTCOMES:

CO1 : Explain the operating principles of Zener diodes, BJTs, op-amps, logic gates, flip-flops, multiplexers, and their roles in analog and digital circuits, and **describe** standard laboratory measurement and safety practices.

CO2 : Perform experimental procedures to **measure and plot** device characteristics such as Zener reverse characteristics, BJT output characteristics, and op-amp configurations, and **use** these results to verify expected circuit behaviors.

CO3: Analyze the frequency response of CE amplifiers, the regulation behavior of power supplies, and the functional performance of logic and arithmetic circuits, **identifying** how component parameters affect the overall operation.

CO4 : Evaluate the efficiency, stability, gain, and waveform quality of amplifiers, oscillators, regulated power supplies, and logic circuits, and **justify** component selection or circuit modifications to improve performance.

CO5 : Design and construct analog and digital circuits such as Wien bridge oscillators, adder circuits, flip-flops, and multiplexers, and **prepare** clear laboratory reports with circuit diagrams, data analysis, and interpretation of results.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	1	1	2	1	3	1	3	1	1
CO2	3	1	1	3	1	3	1	1	2	3	1
CO3	3	1	3	3	1	2	1	1	3	3	2
CO4	3	1	3	3	1	2	1	1	2	3	3
CO5	3	3	3	2	3	3	1	2	2	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC9: Special theory of relativity)

COURSE OUTCOMES:

CO1: Describe the limitations of Newtonian relativity and the postulates forming the basis of special relativity.

CO2: Illustrate the physical consequences of Lorentz transformations such as time dilation, length contraction, and simultaneity.

CO3: Differentiate various relativistic effects such as Doppler shift, twin paradox, and relativistic collisions.

CO4: Appraise the relationship between energy, mass, and momentum within the framework of relativistic dynamics.

CO5: Construct space-time diagrams and formulate problems using four-vector and tensor representations.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	1	1	0	0	1	3	3	0	1
CO2	3	1	3	3	0	1	1	2	3	1	1
CO3	3	1	3	3	1	1	1	2	3	1	3

CO4	3	1	3	3	1	1	1	2	3	1	3
CO5	3	1	3	2	1	3	1	2	3	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (MC10 : Advance Quantum Mechanics)

COURSE OUTCOMES:

CO1: Describe the quantum theory of hydrogen-like atoms and the significance of quantum numbers.

CO2: Solve problems for atomic systems using the variational method.

CO3: Distinguish tunneling and bound-state behaviors of particles through the WKB approximation.

CO4: Appraise the effects of perturbations on atomic energy levels and transition probabilities.

CO5: Construct quantum models for radiative transitions and atomic interactions.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	1	0	0	1	3	3	0	1
CO2	3	1	3	3	0	2	1	2	3	2	1
CO3	3	1	3	3	0	1	1	2	3	1	3
CO4	3	1	3	2	0	1	1	2	3	1	3
CO5	3	1	3	2	1	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

SEMESTER-V

COURSE 1 (MC11: Solid State Physics; Component: Theory)

COURSE OUTCOMES:

CO1: Examine the crystal structure by x-ray diffraction and understand the bonds in solids.

CO2: Distinguish the magnetic, dielectric and ferroelectric properties of materials and illustrate their mechanisms and applications.

CO3: Demonstrate lattice vibrations in solids and use it to examine thermal properties of solids.

CO4: Select solids as metals, semiconductors or insulators using the Band theory.

CO5: Differentiate between normal and superconducting materials.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	2	1
CO2	3	2	3	2	1	1	1	2	3	1	3
CO3	2	1	3	2	1	3	1	2	2	3	2
CO4	3	1	3	3	1	1	1	2	3	1	3
CO5	3	1	3	2	1	1	1	2	3	1	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 1 (MC11: Solid State Physics; Component: Practical)

COURSE OUTCOMES:

CO1: List the fundamental concepts and definitions relevant to the measurement of magnetic susceptibility, resistivity, and dielectric constant of solids.

CO2: Summarize the working principles of experimental setups used in solid-state physics lab investigations such as Hall effect and Curie temperature.

CO3: Demonstrate the procedure to determine the resistivity of a semiconductor and the dielectric constant of insulating materials.

CO4: Differentiate between various solid-state materials based on their B-H curve characteristics and temperature-dependent resistivity behavior.

CO5: Formulate conclusions from observed experimental data and design appropriate methods to determine band gap and Hall coefficient of semiconductors.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	1	1	0	1	1	2	3	1	1
CO2	3	1	2	2	1	1	1	2	3	2	2
CO3	3	1	2	3	1	3	1	2	2	3	2
CO4	2	1	3	2	1	1	1	2	3	2	3
CO5	2	2	3	3	1	2	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC12: Electrodynamics-II; Component: Theory)

COURSE OUTCOMES:

CO1: Explain Maxwell's equations and their applications.

CO2. Illustrate the propagation of electromagnetic in vacuum, conducting and dielectric medium

CO3. Differentiate linear, circular and elliptical polarisations of EM waves and analyse production as well as detection of waves in laboratory.

CO4: Examine the use of optical elements to characterize light polarization and verify Fresnel's theory.

CO5: Design an elementary optical communication system using planar waveguides and optical fibers.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	1	0	1	1	3	3	1	1
CO2	3	1	3	2	0	1	1	2	3	1	2
CO3	3	2	3	3	1	1	1	2	3	3	2
CO4	2	2	2	3	1	1	1	2	2	3	2
CO5	2	2	3	2	1	3	1	3	2	2	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC12: Electrodynamics-II; Component: Practical)

COURSE OUTCOMES:

CO1: Verify Malus's Law and determine Brewster's angle.

CO2: Detect the specific rotation of sugar solution using Polarimeter and the wavelength and velocity of ultrasonic waves in a liquid.

CO3: Demonstrate the reflection, refraction, Polarization and double slit interference in microwaves.

CO4: Examine the behaviour of polarized and elliptically polarized light using Babinet's compensator and evaluate dependence of radiation on angle for a simple Dipole antenna

CO5: Detect the refractive index of glass and liquid using different methods and the specific charge of an electron by bar magnet method.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	3	1	2	1	2	2	3	1
CO2	3	2	3	2	1	2	1	2	2	3	1
CO3	3	2	3	3	1	2	1	2	3	3	2
CO4	3	2	3	3	1	2	1	2	3	3	2
CO5	3	2	3	3	1	2	1	2	3	3	2

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (MC13 Electrical Technology; Component: Theory)

COURSE OUTCOMES:

CO1: Explain the fundamental laws of circuit theorems and their implications.

CO2: Execute AC circuit in terms of RLC components.

CO3: Examine the three-phase AC circuit in terms of Delta-Star and Star-Delta Transformation.

CO4: Verify the performance of transformers.

CO5: Test the performance of special motors and electrical instruments.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	1	0	1	1	1	3	1	1
CO2	2	1	2	1	1	2	1	1	2	3	1
CO3	2	1	3	2	1	1	1	1	3	2	2
CO4	3	1	2	3	2	2	1	1	2	3	2
CO5	3	1	3	1	1	3	1	1	2	2	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (MC13 Electrical Technology; Component: Practical)

COURSE OUTCOMES:

CO1: Verify and interpret basic circuit laws such as Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) in electrical circuits.

CO2: Analyze R-L-C series and parallel AC circuits through measurement of current, voltage, and phase angles, and construct phasor diagrams to determine power factor.

CO3: Measure inductance of a choke coil using practical setup and validate using LCR meter; compute the quality (Q) factor.

CO4: Monitor conditions for series and parallel resonance in AC circuits through practical observations.

CO5: Verify DC network theorems, including Superposition, Thevenin's, Norton's, and Maximum Power Transfer Theorem using experimental methods.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	1	3	2	1
CO2	3	1	3	2	1	2	1	1	2	3	1
CO3	2	1	3	2	1	3	1	1	1	3	1
CO4	3	1	3	3	1	2	1	1	3	3	1
CO5	3	1	3	3	2	2	1	1	2	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 1 (MC14: Atomic, Molecular and Laser physics)

COURSE OUTCOMES:

CO1: Explain the principles of atomic and molecular spectroscopy, including spectral term symbols, selection rules, coupling schemes, Zeeman and Stark effects, and describe the fundamentals of molecular symmetry and point group classification.

CO2: Apply symmetry operations, character tables, and spectroscopic selection rules to identify vibrational and rotational transitions and predict IR and Raman activity in molecules.

CO3: Analyze experimental spectra obtained from photoelectron, rotational, vibrational, Raman, and electronic spectroscopy to interpret molecular structure, energy level splitting, isotope effects, and vibrational–rotational interactions.

CO4: Evaluate spectroscopic data to determine molecular parameters such as bond lengths, force constants, rotational constants, and hyperfine splitting, and assess the influence of external fields (magnetic/electric) on spectral features.

CO5: Design spectroscopic measurement strategies using appropriate instruments (microwave, IR, Raman, photoelectron spectrometers, lasers) and propose suitable spectroscopic techniques for analyzing atomic and molecular systems in research or applied contexts.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	2	1	2	1	2	3	2	3
CO3	3	2	3	3	1	2	1	2	3	2	3
CO4	3	2	3	3	1	2	1	2	3	2	3
CO5	3	2	3	3	2	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC15: Solid State Devices)

COURSE OUTCOMES:

CO1 : Explain the crystal structure, lattice orientations, and bulk crystal growth techniques of semiconductor materials, and describe the formation of epitaxial layers and lattice matching requirements.

CO2 : Apply semiconductor physics principles to interpret energy band diagrams, carrier concentrations, Fermi levels, and the behavior of intrinsic and extrinsic semiconductors under equilibrium and non-equilibrium conditions.

CO3 : Analyze carrier transport mechanisms such as drift, diffusion, mobility variations, Hall effect, and continuity equations to determine current flow, diffusion length, and quasi-Fermi level gradients in semiconductors.

CO4 : Evaluate the electrical characteristics of PN junctions, Schottky contacts, and heterojunctions by assessing charge distribution, breakdown mechanisms, capacitance behavior, and transient effects under various biasing conditions.

CO5: Design MOS capacitor and MOSFET structures, derive their operating equations, and propose scaling strategies and advanced device architectures (e.g., FinFET) to overcome short-channel effects and enhance device performance.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	2	1	2	3	2	1
CO2	3	2	3	2	1	3	1	2	3	3	2
CO3	3	2	3	2	1	3	1	2	3	3	3
CO4	3	2	3	2	2	3	1	2	3	3	3
CO5	3	2	3	2	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (MC16: Material Science and Nanotechnology)

COURSE OUTCOMES:

CO1 : Explain the classification, bonding nature, and fundamental properties of engineering materials, including metals, alloys, semiconductors, crystalline and non-crystalline solids.

CO2 : Apply the principles of light–matter interaction to interpret optical properties such as absorption, reflection, refraction, scattering, and excitonic effects in different classes of materials.

CO3 : Analyze nanoscale structures using concepts of band structure, density of states, and quantum confinement, and distinguish between 0D, 1D, 2D, and 3D nanostructures in terms of their physical behavior.

CO4 : Evaluate different nanomaterial synthesis techniques (top-down and bottom-up) and assess their suitability for specific applications based on processing conditions, cost, and structural control.

CO5 : Design a material characterization strategy using techniques such as XRD, SEM, TEM, AFM, STM, and UV-Vis, and propose suitable nanomaterials for photonic, electronic, magnetic, and MEMS/NEMS device applications.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	2	1	2	1	2	3	2	3
CO3	3	2	3	3	1	2	1	2	3	2	3
CO4	3	2	3	3	1	2	1	2	3	2	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

SEMESTER-VII

COURSE 1 (MC17: Astrophysics & Space Science)

COURSE OUTCOMES:

CO1 : Recall the fundamental concepts of observational astronomy, stellar classification, plasma parameters, and solar system structure, and explain the physical principles governing stars, interstellar medium, and solar–terrestrial interactions.

CO2 : Apply stellar structure equations, radiative transfer principles, and plasma dynamics to analyze stellar evolution, energy transport processes, and charged particle motion in magnetic fields.

CO3 : Analyze interacting binary systems, accretion processes, high-energy astrophysical emissions (e.g., synchrotron, bremsstrahlung, Compton scattering), and distinguish between mechanisms contributing to X-ray, radio, and cosmic-ray sources.

CO4 : Evaluate the role of solar magnetic fields, magnetohydrodynamic processes, ionospheric conductivity variations, and space-weather perturbations in shaping magnetospheric dynamics and Earth–Sun environmental interactions.

CO5 : Design and interpret astronomical/solar observations and plasma diagnostics using satellite and ground-based instrumentation, and construct conceptual or computational models to predict astrophysical or space-environment behavior.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	3	1	2	1	2	3	2	3
CO3	3	2	3	3	1	2	1	2	3	2	3
CO4	3	2	3	3	1	2	1	2	3	2	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC18: Spectroscopic Technique)

COURSE OUTCOMES:

CO1 : Explain the fundamental principles of NMR, ESR, Mossbauer, Raman, UV photoemission, vibrational and photon correlation spectroscopy, including nuclear/electron spin behavior, hyperfine interactions, and radiation–matter interaction mechanisms.

CO2 : Apply chemical shift values, coupling patterns, relaxation mechanisms, ion fragmentation rules, and Raman/IR selection rules to interpret NMR, ESR, Mossbauer, and Mass spectra for structural identification of organic and inorganic compounds.

CO3 : Analyze first- and second-order NMR spectra (AX, AB, AMX systems), ESR splitting patterns, Mossbauer quadrupole/hyperfine interactions, and mass spectral fragmentation pathways to distinguish stereochemical, electronic, and bonding environments in molecules.

CO4 : Evaluate spectroscopic data obtained from FT-NMR, MALDI-TOF, ESIMS, Raman, and AR-UPS techniques to justify structural assignments, dynamic molecular behavior, ligand-field effects, and electronic transitions in diverse chemical systems.

CO5 : Design integrated spectroscopic strategies combining NMR, ESR, Mossbauer, Raman, Mass, and photoemission methods to solve advanced structure elucidation problems and develop experimental protocols for molecular characterization.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	3	1	2	1	2	3	2	3
CO3	3	2	3	3	1	2	1	2	3	2	3

CO4	3	2	3	3	1	2	1	2	3	2	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (MC19: Quantum Computation)

COURSE OUTCOMES:

CO1 : Explain the concepts of classical computation, qubits, quantum states, entanglement, and quantum measurement, including Bloch sphere representation and the role of density operators.

CO2 : Apply quantum gate operations (Hadamard, Phase, Pauli, CNOT, Controlled gates) and construct quantum circuits to manipulate qubits, perform basis transformations, and demonstrate quantum parallelism.

CO3 : Analyze quantum algorithms such as Deutsch, Deutsch–Jozsa, Grover Search, Quantum Fourier Transform, Phase Estimation, and Quantum Teleportation to differentiate their computational advantages over classical algorithms.

CO4 : Evaluate quantum measurement strategies, quantum error correction schemes (Shor code), quantum noise models, and cryptographic protocols to assess reliability, security, and information fidelity in quantum information processing.

CO5 : Design small-scale quantum circuits and formulate quantum computation/communication protocols using entanglement, superdense coding, and teleportation; propose feasible physical realizations (ion-trap, NMR, or cavity QED) for practical implementations.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	3	1	3	1	2	3	2	3
CO3	3	2	3	3	1	3	1	2	3	2	3
CO4	3	2	3	3	1	3	1	2	3	2	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 4 (MC20: Medical Physics)

COURSE OUTCOMES:

CO1 : Explain the physical properties, sources, and biological interactions of non-ionizing radiations, including laws of photochemistry, electrical-biological impedance, and principles of thermography.

CO2 : Apply the concepts of tissue optics to analyze laser–tissue interactions such as photothermal, photochemical, photoablation, and electromechanical effects, and evaluate fluence measurements for medical laser systems.

CO3 : Analyze the use of lasers, ultrafast optical sources, fluorescence and confocal microscopy, and fiber optics in biomedical diagnostics and therapeutic procedures, including assessment of laser hazards and safety standards.

CO4 : Evaluate ultrasonic wave propagation, acoustic properties of tissues, ultrasound dosimetry, cavitation mechanisms, and lithotripsy to assess suitability for diagnostic imaging and therapeutic applications.

CO5 : Design medical application strategies involving RF, microwave, and ultrasound modalities for hyperthermia, tissue characterization, and biomagnetism-based diagnostics, proposing safe and effective clinical usage protocols.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	3	1	3	1	2	3	3	3
CO3	3	2	3	3	1	3	1	2	3	3	3
CO4	3	2	3	3	1	3	1	2	3	3	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

SEMESTER-VIII

COURSE 1 (MC21: Acoustics & Sound Engineering)

COURSE OUTCOMES:

CO1 : Explain the fundamental principles of acoustics, including sound propagation, frequency, amplitude, resonance, and acoustic environments relevant to recording spaces.

CO2 : Demonstrate the basic techniques of analogue and digital audio recording, describing the evolution of recording technologies and their practical applications in modern audio production.

CO3 : Analyze the stages of the recording process—recording, mixing, and mastering—to identify how each stage influences the quality and character of the final audio output.

CO4 : Evaluate the functionality and selection criteria of recording studio equipment (microphones, mixers, monitors, interfaces, etc.) and assess studio architectural features for optimal acoustic treatment.

CO5 : Create and produce a complete audio project using professional recording software, integrating recording, editing, mixing, and mastering techniques according to industry standards.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	1	1	2	3	1	2
CO2	3	2	3	2	1	3	1	2	3	3	3
CO3	3	2	3	3	2	3	1	2	3	3	3
CO4	3	2	3	3	2	3	1	2	3	3	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 2 (MC22: COMPUTATIONAL PHYSICS)

COURSE OUTCOMES:

CO1 : Explain the fundamental numerical concepts, sources of computational errors (round-off and truncation), and describe classical root-finding and linear system-solving techniques including Gauss-based elimination and iterative methods.

CO2 : Apply interpolation (Lagrange, Newton, spline) and approximation techniques, and implement numerical integration, optimization algorithms, and numerical solutions for ordinary and partial differential equations using standard computational tools.

CO3 : Analyze molecular dynamics simulations, Verlet and predictor-corrector algorithms, lattice-Boltzmann and particle-in-cell methods, and evaluate numerical schemes for solving Schrödinger equations using basis functions and variational techniques.

CO4 : Critically evaluate the principles of density functional theory and Monte Carlo simulation strategies (Metropolis, block algorithms), and assess their applicability to classical and quantum systems.

CO5: Design computational solutions to complex scientific problems by integrating classical numerical methods with modern algorithms, and construct algorithmic workflows for problem classes in P, NP, and NP-complete, including applications of Shor's and Grover's quantum algorithms.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	2	1	2	3	2	2
CO2	3	2	3	2	1	3	1	2	3	3	3
CO3	3	2	3	3	2	3	1	2	3	3	3
CO4	3	2	3	3	2	3	1	2	3	3	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 3 (ME: Course1: Plasma Physics)

COURSE OUTCOMES:

CO1 : Explain the basic nature of plasma as the fourth state of matter, describe ionization processes using the Saha equation, and summarize key plasma characteristics such as Debye shielding, quasi-neutrality, collective behavior, and plasma confinement techniques.

CO2 : Apply kinetic theory concepts to interpret plasma distribution functions and use the Vlasov equation and fluid moments to analyze simple plasma conditions.

CO3 : Analyze single-fluid and two-fluid models to derive basic plasma fluid equations, and examine linear dispersion relations for electrostatic waves including Langmuir, ion-acoustic, upper-hybrid, and lower-hybrid modes.

CO4 : Evaluate nonlinear plasma phenomena such as Landau damping, Korteweg–de Vries (KdV) solitary waves, and various instability mechanisms to assess their influence on plasma wave propagation and energy transfer.

CO5 : Develop plasma modeling strategies by implementing perturbation techniques and numerical simulation tools to construct predictive models for laboratory and astrophysical plasma behavior

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	2	1	2	3	2	2
CO2	3	2	3	2	1	3	1	2	3	3	3
CO3	3	2	3	3	2	3	1	2	3	3	3
CO4	3	2	3	3	2	3	1	2	3	3	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 4 (ME: Course2: Condensed Matter Physics)

COURSE OUTCOMES:

CO1 : Describe semiclassical electron transport in solids and explain phenomena such as Hall effect, magnetoresistance, and de Haas–van Alphen oscillations; summarize carrier behavior in homogeneous and inhomogeneous semiconductors including p–n junctions and rectification.

CO2 : Apply lattice vibration models to determine phonon dispersion relations, calculate lattice heat capacities using Debye and Einstein models, and interpret infrared optical properties and thermal expansion in crystals.

CO3 : Analyze screening mechanisms and compare Thomas–Fermi and Lindhard dielectric response models; examine local field effects and distinguish ferroelectric behavior from conventional dielectrics based on polarization characteristics.

CO4 : Evaluate magnetic phase transitions using mean-field and Heisenberg models, assess spin wave excitations in ferro- and antiferromagnets, and justify the relationship between magnetic order and temperature dependence.

CO5 : Integrate theoretical concepts of superconductivity to construct energy gap explanations using BCS theory, formulate Ginzburg–Landau expressions for superconducting states, and interpret tunneling and Josephson effects in designing superconducting devices.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	2	1	2	3	2	2
CO2	3	2	3	2	1	3	1	2	3	3	3
CO3	3	2	3	3	2	3	1	2	3	3	3
CO4	3	2	3	3	2	3	1	2	3	3	3
CO5	3	2	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

COURSE 5 (ME: Course 3: General Theory of Relativity)

COURSE OUTCOMES:

CO1 : Explain the equivalence principle and differentiate between inertial and non-inertial frames, non-Euclidean geometry, and general coordinate transformations to interpret the general covariance of physical laws.

CO2 : Analyze the geometrical foundation of General Relativity by applying covariant and contravariant tensors, metric tensor operations, covariant derivatives, Christoffel symbols, and geodesic equations to solve problems related to particle motion in gravitational and electromagnetic fields.

CO3 : Examine the Einstein field equations, energy-momentum tensor, and Hilbert's variational principle, and demonstrate the physical interpretation of gravitational waves and radiation through the linearized approximation of the field equations.

CO4 : Evaluate classical tests of General Relativity (perihelion shift, light bending, gravitational redshift, radar echo delay) and interpret Schwarzschild, Kerr, Reissner–Nordström, and other black hole solutions to assess singularities, ergospheres, and horizon structures.

CO5 : Construct cosmological models using Robertson–Walker metric, Raychaudhuri equation, and Weyl's postulate, and formulate arguments regarding the formation and inevitability of singularities based on Hawking–Penrose theorems.

MAPPING OF COs WITH POs AND PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES								PROGRAMME SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	1	2	2	1	2	1	2	3	2	2

CO2	3	1	3	2	1	3	1	2	3	3	3
CO3	3	1	3	2	1	3	1	2	3	3	3
CO4	3	1	3	3	2	3	1	2	3	3	3
CO5	3	1	3	3	3	3	1	3	3	3	3

1. LOW 2. MODERATE 3. SUBSTANTIAL

Bloom's Taxonomy Verbs:

Remember (BT1)	**Understand (BT2)**	**Apply (BT3)**	**Analyze (BT4)**	**Evaluate (BT5)**	**Create (BT6)**
Cite	Add	Acquire	Analyze	Appraise	Abstract
Define	Approximate	Adapt	Audit	Assess	Animate
Describe	Articulate	Allocate	Blueprint	Compare	Arrange
Draw	Associate	Alphabetize	Breadboard	Conclude	Assemble
Enumerate	Characterize	Apply	Break down	Contrast	Budget
Identify	Clarify	Ascertain	Characterize	Counsel	Categorize
Index	Classify	Assign	Classify	Criticize	Code
Indicate	Compare	Attain	Compare	Critique	Combine
Label	Compute	Avoid	Confirm	Defend	Compile
List	Contrast	Back up	Contrast	Determine	Compose
Match	Convert	Calculate	Correlate	Discriminate	Construct
Meet	Defend	Capture	Detect	Estimate	Cope
Name	Describe	Change	Diagnose	Evaluate	Correspond
Outline	Detail	Classify	Diagram	Explain	Create
Point	Differentiate	Complete	Differentiate	Grade	Cultivate
Quote	Discuss	Compute	Discriminate	Hire	Debug
Read	Distinguish	Construct	Dissect	Interpret	Depict
Recall	Elaborate	Customize	Distinguish	Judge	Design
Recite	Estimate	Demonstrate	Document	Justify	Develop
Recognize	Example	Depreciate	Ensure	Measure	Devise
Record	Explain	Derive	Examine	Predict	Dictate
Repeat	Express	Determine	Explain	Prescribe	Enhance
Reproduce	Extend	Diminish	Explore	Rank	Explain
Review	Extrapolate	Discover	Figure out	Rate	Facilitate
Select	Factor	Draw	File	Recommend	Format
State	Generalize	Employ	Group	Release	Formulate
Study	Give	Examine	Identify	Select	Generalize
Tabulate	Infer	Exercise	Illustrate	Summarize	Generate
Trace	Interact	Explore	Infer	Support	Handle
Write	Interpolate	Expose	Interrupt	Test	Import
	Interpret	Express	Inventory	Validate	Improve
	Observe	Factor	Investigate	Verify	Incorporate
	Paraphrase	Figure	Layout		Integrate
	Picture graphically	Graph	Manage		Interface
	Predict	Handle	Maximize		Join
	Review	Illustrate	Minimize		Lecture
	Rewrite	Interconvert	Optimize		Model
	Subtract	Investigate	Order		Modify

	Summarize	Manipulate	Outline		Network
	Translate	Modify	Point out		Organize
	Visualize	Operate	Prioritize		Outline
		Personalize	Proofread		Overhaul
		Plot	Query		Plan
		Practice	Relate		Portray
		Predict	Select		Prepare
		Prepare	Separate		Prescribe
		Price	Subdivide		Produce
		Process	Train		Program
		Produce	Transform		Rearrange
		Project			Reconstruct
		Provide			Relate
		Relate			Reorganize
		Round off			Revise
		Sequence			Rewrite
		Show			Specify
		Simulate			Summarize
		Sketch			
		Solve			
		Subscribe			
		Tabulate			
		Transcribe			
		Translate			
		Use			