Department of Physics

Program Outcomes, Course Outcomes and their mapping

Course Title: Mechanics and Properties of Matter
Program: B.Sc. Physics
Semester: Semester II

Course Outcomes (COs)

At the end of this course, students will be able to:

- **CO1:** Understand the basic laws of motion, forces, and conservation principles.
- **CO2:** Analyze the motion of particles and rigid bodies in various reference frames.
- **CO3:** Apply the principles of elasticity, surface tension, and viscosity in practical situations.
- **CO4:** Solve problems involving fluid mechanics and mechanical properties of matter.
- **CO5:** Develop experimental skills related to measurements of mechanical properties.

Program Outcomes (POs) – B.Sc. Physics

- **PO1:** Demonstrate comprehensive knowledge in Physics and related disciplines.
- **PO2:** Develop analytical and problem-solving skills using scientific methods.
- **PO3:** Apply theoretical and practical concepts to conduct experiments and analyze results.
- **PO4:** Communicate scientific information effectively in oral and written formats.
- **PO5:** Engage in lifelong learning and apply physics knowledge to societal needs.

Program Specific Outcomes (PSOs) – B.Sc. Physics

- **PSO1:** Acquire in-depth knowledge of classical mechanics, quantum mechanics, electromagnetism, and modern physics.
- **PSO2:** Utilize laboratory techniques and instrumentation in experimental physics.
- **PSO3:** Solve real-world problems using physics principles and computational tools.
- **PSO4:** Pursue higher studies or employment in scientific, technical, or academic fields.

CO-PO Mapping Matrix

CO \ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	1	1
CO2	3	3	2	1	1
CO3	2	3	3	1	2
CO4	2	3	3	1	2
CO5	1	2	3	2	3

Legend:
3 – Strongly correlated
2 – Moderately correlated
1 – Slightly correlated
0 – Not correlated

Course Title: Waves and Oscillations
Semester: II

Course Outcomes (COs)

After completing this course, students will be able to:

CO1: Understand the basic principles and mathematical formulation of simple harmonic motion (SHM).
CO2: Analyze the superposition of SHMs and the concept of Lissajous figures.
CO3: Understand the concept of damping and forced oscillations, including resonance phenomena.
CO4: Study the properties of waves in various media and derive wave equations.
CO5: Examine the formation, propagation, and characteristics of stationary and progressive waves.
CO6: Apply the principles of acoustics in understanding resonance tubes, musical instruments, and sound absorption.

Program Outcomes (POs)

PO1: Critical Thinking – Apply the knowledge of science to identify, analyze and solve complex problems.
PO2: Effective Communication – Communicate scientific information effectively through oral and written formats.
PO3: Social Interaction – Exhibit social and professional ethics in collaborative settings.
PO4: Environment and Sustainability – Understand environmental issues and sustainable development.
PO5: Lifelong Learning – Recognize the need for self-motivated learning in the context of scientific advancement.

Program Specific Outcomes (PSOs) – B.Sc. Physics

PSO1: Demonstrate a thorough understanding of core concepts in physics including mechanics, waves, thermodynamics, electromagnetism, and modern physics.
PSO2: Develop laboratory skills to conduct experiments, analyze data, and interpret results accurately.
PSO3: Apply theoretical physics principles in modeling real-world physical systems and solving related problems.
PSO4: Use modern scientific tools and techniques to address practical challenges and explore new frontiers in physics.

CO-PO Mapping Matrix

Course Outcomes \ Program Outcomes	PO1	PO2	PO3	PO4	PO5
CO1: SHM fundamentals	3	2	1	-	2
CO2: Superposition & Lissajous	3	3	2	-	2
CO3: Damping & resonance	3	2	1	-	2
CO4: Wave equations	3	2	-	-	3
CO5: Stationary/progressive waves	2	2	-	-	3
CO6: Acoustics applications	2	3	2	2	3

(3: Strongly related, 2: Moderately related, 1: Slightly related, -: Not related)

Course: OPTICS (B.Sc. Physics – Semester III)

Course Outcomes (COs):

After completing this course, students will be able to:

- **CO1**: Understand the fundamental principles of wave optics and the behavior of light as a wave.
- **CO2**: Analyze and interpret the interference and diffraction phenomena in various optical systems.
- **CO3**: Apply the concepts of polarization and optical instruments in practical applications.
- **CO4**: Explain and demonstrate the working of lasers, optical fibers, and their technological applications.

Program Outcomes (POs):

Graduates of the B.Sc. Physics program will be able to:

- **PO1**: Demonstrate a deep understanding of physical concepts, theories, and applications.
- **PO2**: Use scientific methods to design, conduct, analyze, and interpret experiments.
- **PO3**: Apply critical thinking and analytical reasoning to solve scientific problems.
- **PO4**: Communicate effectively and present scientific ideas clearly.
- **PO5**: Utilize modern tools and techniques for scientific exploration.
- **PO6**: Demonstrate ethical awareness and responsibility in scientific contexts.

Program Specific Outcomes (PSOs):

Students graduating with a B.Sc. in Physics will be able to:

- **PSO1**: Apply concepts of classical mechanics, quantum physics, thermodynamics, and electromagnetism in solving physical problems.
- **PSO2**: Employ mathematical tools and experimental techniques for data analysis in physics.
- **PSO3**: Utilize physics knowledge for interdisciplinary research and technology development.

CO-PO Mapping Matrix (Course: OPTICS)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	2	1
CO2	3	3	3	2	2	1
CO3	2	2	2	2	3	2
CO4	2	3	3	2	3	2

(Scale: 1 = Low, 2 = Moderate, 3 = High)

B.Sc. Physics – Semester 3

Course Title: Heat and Thermodynamics

Course Outcomes (COs)

After successful completion of the course, students will be able to:

CO1: Understand the fundamental concepts of temperature, heat, and the laws of thermodynamics.
CO2: Apply the first and second laws of thermodynamics to various physical and engineering systems.
CO3: Analyze thermodynamic processes and cycles, including Carnot, Otto, and Diesel cycles.
CO4: Explain entropy, its physical significance, and implications in natural processes.
CO5: Evaluate the thermal properties of matter including specific heat, thermal conductivity, and thermal expansion.

Program Outcomes (POs)

PO1: Demonstrate knowledge in foundational and advanced concepts in Physics.
PO2: Apply the principles of Physics to solve real-world problems.
PO3: Use scientific methods to analyze data, interpret results, and draw conclusions.
PO4: Communicate effectively using scientific language and tools.
PO5: Demonstrate ethical conduct, teamwork, and lifelong learning abilities in scientific domains.

Program Specific Outcomes (PSOs)

PSO1: Gain conceptual and experimental understanding in core areas of Physics including mechanics, heat, optics, electricity, magnetism, and quantum physics.
PSO2: Acquire laboratory skills for accurate measurement and data analysis.
PSO3: Apply Physics concepts to interdisciplinary problems and advanced technologies.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	1	1

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

(3 = Strongly correlated, 2 = Moderately correlated, 1 = Slightly correlated)

B.Sc. Physics - Semester 3
Course Title: ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes (COs)

After successful completion of this course, students will be able to:

- **CO1:** Understand the basic operation and characteristics of semiconductor devices like diodes, transistors, and FETs.
- **CO2:** Analyze and design rectifier circuits and power supplies.
- **CO3:** Understand transistor biasing techniques and evaluate their stability.
- **CO4:** Design and analyze small signal amplifier circuits.
- **CO5:** Explore the frequency response of amplifiers and feedback circuits.

Program Outcomes (POs)

- **PO1:** Demonstrate knowledge of major concepts, theoretical principles, and experimental findings in science.
- **PO2:** Apply scientific methods to design, conduct and interpret experiments.
- **PO3:** Develop scientific temperament and contribute to society through scientific innovations.
- **PO4:** Communicate scientific information effectively in oral and written formats.
- **PO5:** Apply modern tools and techniques for solving real-world problems.
- **PO6:** Recognize and follow ethical practices in scientific research and professional activities.

Program Specific Outcomes (PSOs) – B.Sc. Physics

- **PSO1:** Apply fundamental principles of physics to analyze real-world physical systems.
- **PSO2:** Design and conduct experiments in electronics, optics, and mechanics with appropriate tools and techniques.
- **PSO3:** Analyze electronic circuits and understand the function of modern devices and systems.
- **PSO4:** Prepare for careers in teaching, industry, or further studies in physical sciences.

CO-PO Mapping Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	1	3	2	3	2
CO2	3	3	2	2	3	1	3	3	3	2
CO3	3	3	2	2	3	2	3	3	3	3
CO4	3	3	2	2	3	2	3	3	3	3
CO5	3	2	2	2	3	1	3	2	3	2

Legend: 3 – Strongly related, 2 – Moderately related, 1 – Slightly related

B.Sc. Physics – Semester 3

Course Title: Analog and Digital Electronics

Course Outcomes (COs):

By the end of this course, students will be able to:

CO1: Understand the working principles and characteristics of semiconductor devices like diodes, BJTs, and FETs.

CO2: Analyze and design analog circuits using operational amplifiers (Op-Amps).

CO3: Explain the principles of digital electronics including number systems, logic gates, and Boolean algebra.

CO4: Construct and troubleshoot combinational and sequential circuits such as adders, multiplexers, flip-flops, and counters.

CO5: Apply the knowledge of analog and digital electronics in real-world applications and laboratory experiments.

Program Outcomes (POs):

PO1: Scientific Knowledge – Apply the knowledge of basic science and fundamentals of physics.

PO2: Problem Analysis – Identify, formulate, and analyze complex problems in physics.

PO3: Design/Development of Solutions – Design solutions for physical problems using appropriate methods.

PO4: Conduct Investigations – Conduct experiments and interpret data to derive valid conclusions.

PO5: Modern Tool Usage – Use modern tools and techniques for physics experiments and analysis.

PO6: Ethics – Apply ethical principles in academic and research practices.

PO7: Communication – Communicate effectively on scientific activities.

PO8: Life-long Learning – Recognize the need for and engage in lifelong learning.

Program Specific Outcomes (PSOs):

PSO1: Understand and apply the core concepts of classical and modern physics.

PSO2: Develop experimental skills and computational techniques to solve real-life physics problems.

PSO3: Demonstrate proficiency in laboratory practices and instrumentation relevant to physics.

CO-PO Mapping Matrix:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	2	1	1	2
CO2	3	2	3	2	3	1	1	2
CO3	3	3	3	2	2	1	1	2
CO4	2	3	3	3	3	1	1	2
CO5	2	2	2	3	3	2	2	3

(Note: 3 – High, 2 – Medium, 1 – Low contribution)

B.Sc. Physics – ELECTRICITY AND MAGNETISM (Semester IV)

Course Outcomes (COs):

After successful completion of the course, students will be able to:

CO1: Understand the fundamental laws of electrostatics, magnetostatics, and their applications.

CO2: Apply Gauss's law and Coulomb's law to solve problems involving electric fields and potentials.

CO3: Analyze the behavior of capacitors and dielectrics in various configurations.

CO4: Understand and apply the principles of magnetism and Ampere's law.

CO5: Examine the concepts of electromagnetic induction and analyze RL, RC, and RLC circuits.

CO6: Demonstrate the ability to solve Maxwell's equations and understand electromagnetic wave propagation.

Program Outcomes (POs):

PO1: Develop a strong foundation in Physics and its application in scientific and technological contexts.

PO2: Analyze and solve problems using principles of physics and mathematical tools.

PO3: Conduct experiments, interpret data, and draw logical conclusions.

PO4: Apply theoretical knowledge to real-world physical systems.

PO5: Communicate scientific ideas effectively in both oral and written forms.

PO6: Demonstrate ethics, responsibility, and sustainability in scientific practice.

PO7: Engage in lifelong learning and research.

Program Specific Outcomes (PSOs):

PSO1: Understand and apply fundamental and advanced concepts of classical and modern physics.

PSO2: Use laboratory techniques and instrumentation effectively to explore physical phenomena.

PSO3: Develop computational and analytical skills to model physical systems.

CO-PO Mapping Matrix:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	3	2	1	2
CO2	3	3	2	3	2	1	2
CO3	2	3	2	2	2	1	2
CO4	3	3	2	3	2	1	2
CO5	3	3	3	3	2	1	2
CO6	3	3	3	3	3	1	3

(*Scale: 3 – Strongly correlated, 2 – Moderately correlated, 1 – Slightly correlated*)

Course Title: Modern Physics
Semester: IV

Course Outcomes (COs)

After successful completion of the course, students will be able to:

CO1: Understand and explain the dual nature of matter and radiation.
CO2: Apply Heisenberg's uncertainty principle and understand quantum mechanical concepts.
CO3: Analyze atomic models and the behavior of electrons in atoms.
CO4: Explain the principles of nuclear physics, radioactivity, and nuclear reactions.
CO5: Interpret the functioning and principles of particle detectors and accelerators.

Program Outcomes (POs)

PO1: Demonstrate knowledge of foundational concepts in physics, mathematics, and chemistry.
PO2: Apply scientific reasoning and quantitative skills to solve complex problems.
PO3: Conduct experiments and analyze data using modern scientific tools.
PO4: Communicate effectively through oral, written, and graphical presentations.
PO5: Develop critical thinking and research skills in physics.
PO6: Engage in lifelong learning and ethical scientific practices.

Program Specific Outcomes (PSOs)

PSO1: Apply theoretical and experimental physics knowledge to real-world problems.
PSO2: Demonstrate proficiency in core physics areas including classical mechanics, quantum physics, and electromagnetism.
PSO3: Utilize mathematical and computational tools to model and solve physical problems.
PSO4: Pursue research or career opportunities in physics-related fields.

CO-PO Mapping Matrix

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	2	3	2	3	3	2	2
CO2	3	3	-	2	3	2	3	3	2	2
CO3	3	3	2	2	3	2	3	3	3	3
CO4	3	3	3	2	3	2	3	3	2	2
CO5	3	2	3	2	3	2	3	3	3	3

(Scale: 3 – Strongly Correlated, 2 – Moderately Correlated, 1 – Slightly Correlated, - – Not Correlated)

Course Title: Introduction to Nuclear and Particle Physics
Semester: IV
Program: B.Sc. Physics

Course Outcomes (COs)

After successful completion of the course, students will be able to:

- **CO1:** Describe the basic properties of the nucleus and fundamental nuclear models.
- **CO2:** Explain the mechanisms of radioactive decay and nuclear reactions.
- **CO3:** Understand the working principles of nuclear detectors and particle accelerators.
- **CO4:** Discuss the fundamental particles, their interactions, and classification within the Standard Model.
- **CO5:** Analyze the applications of nuclear and particle physics in fields such as medicine, energy, and research.

Program Outcomes (POs)

Graduates of the B.Sc. Physics program will be able to:

- **PO1:** Demonstrate a solid foundation in the concepts and applications of Physics.
- **PO2:** Apply the scientific method and modern tools to identify, analyze, and solve problems in physics and related fields.
- **PO3:** Design experiments, analyze data, and interpret results.
- **PO4:** Communicate scientific knowledge effectively in oral and written forms.
- **PO5:** Engage in self-directed learning and continuous professional development.

Program Specific Outcomes (PSOs)

Students graduating with a B.Sc. in Physics will be able to:

- **PSO1:** Apply theoretical knowledge of physics to real-world problems and technological advancements.
- **PSO2:** Utilize laboratory techniques and instruments for accurate data collection and analysis.
- **PSO3:** Understand advanced topics in modern physics, including quantum mechanics, nuclear physics, and particle physics.

CO-PO Mapping Matrix

Course Outcomes \ Program Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	1	1
CO2	3	3	3	1	2
CO3	2	3	3	2	2
CO4	3	2	1	2	2
CO5	2	2	1	3	3

Note:

3 = Strongly related, 2 = Moderately related, 1 = Slightly related

Course Title: Applications of Electricity and Magnetism
Course Code: (To be filled by the institution)
Semester: V
Programme: B.Sc. Physics

Course Outcomes (COs):

After successful completion of the course, students will be able to:

CO1. Explain the fundamental concepts of electrostatics, Gauss's law, and electric field in various geometries.
CO2. Apply the principles of capacitance and dielectric materials in practical circuits and devices.
CO3. Analyze steady current circuits using Kirchhoff's laws and Thevenin's and Norton's theorems.
CO4. Understand the laws of magnetostatics and solve problems involving magnetic fields due to currents.
CO5. Demonstrate knowledge of electromagnetic induction, mutual inductance, and AC circuits.
CO6. Understand Maxwell's equations and their applications in electromagnetic wave propagation.

Program Outcomes (POs):

PO1. Demonstrate knowledge of basic concepts in Physics and apply them to real-world problems.
PO2. Use mathematical tools and physical reasoning for scientific analysis and problem-solving.
PO3. Develop laboratory and technical skills through experimentation and instrumentation.
PO4. Communicate scientific ideas effectively through oral and written means.
PO5. Practice ethical responsibilities and engage in lifelong learning.

Program Specific Outcomes (PSOs):

PSO1. Acquire fundamental knowledge in classical mechanics, electromagnetism, optics, quantum mechanics, and electronics.
PSO2. Apply physics concepts to design and conduct experiments using modern instruments.
PSO3. Develop analytical skills for interpreting scientific data and solving theoretical and applied physics problems.

CO-PO Mapping Matrix:

COs \ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	1
CO2	3	2	3	2	1
CO3	3	3	3	2	1
CO4	3	3	2	2	1
CO5	3	3	3	2	1
CO6	3	3	2	2	2

Legend:
3 – Strongly related
2 – Moderately related
1 – Slightly related
0 – Not related

Course Title: ELECTRONIC INSTRUMENTATION
Program: B.Sc. Physics
Semester: V

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Understand the basic principles and working of electronic instruments used for measurement.
CO2: Analyze signal conditioning systems and understand their role in instrumentation.
CO3: Explain the working of transducers and sensors used in various physical measurements.
CO4: Demonstrate the use of digital instruments such as digital multimeters and oscilloscopes.
CO5: Develop basic circuits for measuring physical parameters such as temperature, pressure, and displacement.

Program Outcomes (POs)

PO1: Demonstrate a coherent understanding of the fundamental concepts of Physics.
PO2: Apply knowledge of physics to design and conduct experiments, as well as to analyze and interpret data.
PO3: Identify, formulate and solve problems in physical sciences.
PO4: Use modern tools and techniques for scientific investigation.
PO5: Develop communication, teamwork, and leadership skills for professional growth.
PO6: Recognize the importance of lifelong learning and updating scientific knowledge.

Program Specific Outcomes (PSOs)

PSO1: Apply theoretical knowledge of physics to practical situations in laboratory and fieldwork.
PSO2: Use scientific techniques and modern instrumentation to explore and understand physical phenomena.
PSO3: Develop problem-solving skills in applied physics and instrumentation.

CO-PO Mapping Matrix

Course Outcomes (COs) \ Program Outcomes (POs)	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	1	2
CO2	2	3	3	3	1	2
CO3	2	2	3	3	2	2
CO4	3	3	3	3	2	3
CO5	2	2	2	3	2	3

(*Scale: 1 = Low, 2 = Medium, 3 = High*)