

## **Bachelor of Science: Physics**

### **Department of Physics**

#### **B.Sc. Physics Program Objectives**

- To understand the concepts and significance of the various physical phenomena.
- To carry out experiments to understand the laws and concepts of Physics.
- To apply the theories learnt and the skills acquired to solve real time problems.
- To acquire a wide range of problem solving skills, both analytical and computational and to apply them.
- To produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community

#### **Programme Specific Outcomes**

The physics department will teach all students core content in Discipline Specific Core Courses including Mechanics; electricity, magnetism and EMT; Statistical and Thermal Physics; Waves and Optics and also in Discipline Specific Elective Courses (Choose one course from Elements of Modern Physics; Solid State Physics and Electronics; Astronomy and Astrophysics) and (Choose one course from Nuclear and particle Physics; Quantum Mechanics; Physics of Devices and Instruments). We also expect students to choose from a few more Skill Enhancement Course (any four). After taking courses in the physics department, students will demonstrate (or acquire);

1. Competence in basic physics, including:
  - i. mechanics, electricity and magnetism, thermodynamics, waves and optics, statistical physics and introductory quantum mechanics. Through these fields, students are to develop broad understanding and skills in physical reasoning, data analysis and interpretation and explain how physics applies to phenomena in the world around them. Understand the importance of renewable energy and its applications.
2. Problem solving competence, including:
  - i. Solve physics problems using qualitative and quantitative reasoning including sophisticated mathematical techniques.
  - ii. Solve real-world problems through idealizations and estimation.
3. Laboratory competence, including:
  - i. Setting up and using a range of equipment to obtain experimental data and critically analyzing this data.
  - ii. Quantitatively determining error in an experiment and using this to assess agreement with a specific theory or set of hypotheses.
  - iii. Understanding and/or creating graphical representations of data.
4. Effective oral and written communication skills, including:
  - i. Communicating basic scientific knowledge and the scientific process to a general audience through writing.
  - ii. Verbally communicating basic scientific knowledge and the scientific process to a general audience.

## Course Outcomes:-

### B.Sc. 1<sup>st</sup> Year

#### MECHANICS

<b>Name of the Course</b>	<b>PHYSICS-DSC 1A: MECHANICS (Credits: Theory-04)Theory</b>
Code	PHYS101TH
<b>Course Outcomes</b> Students will be able to articulate and describe: 1 Relative motion. Inertial and non inertial reference frames. 2 Parameters defining the motion of mechanical systems and their degrees of freedom. 3 Study of the interaction of forces between solids in mechanical systems. 4 Centre of mass and inertia tensor of mechanical systems. 5 Application of the vector theorems of mechanics and interpretation of their results. 6 Newton's laws of motion and conservation principles. 7 Introduction to analytical mechanics as a systematic tool for problem solving.	

#### MECHANICS LAB

<b>Name of the Course</b>	<b>PHYSICS-DSC 1A LAB: MECHANICS (Credits: -02)</b>
Code	PHYS 101PR
<b>Course Outcomes</b> 1. To develop ability to model and analysis of mechanics using vector representation of forces and moments. 2. To be able to draw the free body diagrams of mechanical components and systems. 3. To understand the phenomenon of friction and ability to solve problem related to the same. Ability to apply the principles of virtual work. 4. To develop the understandings of fundamental principles of Mechanics	

#### ELECTRICITY, MAGNETISM AND EMT

<b>Name of the Course</b>	<b>PHYSICS-DSC 1B: ELECTRICITY, MAGNETISM AND EMT(Credits: Theory-04)Theory</b>
Code	PHYS102TH
<b>Course Outcomes</b> 1. Ability to understand, Fundamental laws and concepts in electricity and magnetism, especially with regard to Maxwells laws- Electrical circuits and the most common components in such: resistors, capacitors, and inductors. 2. To understand ,the properties of static electric and magnetic fields and how they arise- The properties of simple, time-dependent electric and magnetic fields and what kind of physical phenomena they generate- Electromagnetic waves and their properties and Important historical experiments in the field of electricity and magnetism. 3. To analyze different problems in electromagnetism using mathematical methods involving vectors and simple differential and integral calculus, both analytically and numerically-	

## ELECTRICITY, MAGNETISM AND EMT LAB

Name of the Course	<b>PHYSICS-DSC 1B LAB: ELECTRICITY, MAGNETISM AND EMT</b> <b>(Credits: -02)</b>
Code	PHYS 102PR
<b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. Analyze electric circuits to compute currents and voltage drops, both in stationary and time-dependent situations-</li><li>2. Solve Maxwells equations for simple systems- Have a rudimentary grasp on how experimental equipment related to electricity and magnetism can be used (this is achieved via lab-exercises)GENERAL COMPETENCY</li><li>3. Account for the importance of electricity and magnetism in society, especially with regard to technological applications, and give concrete examples of the latter- Point to a plausible physical origin of simple electromagnetic phenomena in nature</li></ol>	

## B.Sc. 2<sup>nd</sup> Year

### STATISTICAL AND THERMAL PHYSICS

Name of the Course	<b>PHYSICS-DSC 1C: STATISTICAL AND THERMAL PHYSICS(Credits: Theory-04) Theory</b>
Code	PHYS201TH
<b>Course Outcomes</b> Students will have the knowledge and skills to: <ol style="list-style-type: none"><li>1. Identify and describe the statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, chemical potential, Free energies, and partition functions.</li><li>2. Use the statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.</li><li>3. Apply the concepts and principles of black-body radiation to analyze radiation phenomena in thermodynamic systems.</li></ol>	

### STATISTICAL AND THERMAL PHYSICS LAB

Name of the Course	<b>PHYSICS-DSC 1C LAB: STATISTICAL AND THERMAL PHYSICS(Credits: -02)</b>
Code	PHYS 201PR
<b>Course Outcomes</b> : Students will have the Practical knowledge about: <ol style="list-style-type: none"><li>1. How to apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc</li><li>2. Analyze phase equilibrium condition and identify types of phase transitions of physical systems.</li><li>3. Make connections between applications of general statistical theory in various branches of physics.</li></ol>	

## WAVES AND OPTICS

<b>Name of the Course</b>	<b>PHYSICS-DSC 1D: WAVES AND OPTICS (Credits: Theory-04) Theory</b>
Code	PHYS202TH
<b>Course Outcomes</b> Students will have the knowledge and skills to: <ol style="list-style-type: none"> <li>1. Appreciate the efficacy of Fourier transforms and their application to physical systems.</li> <li>2. Understand linear, time-invariant systems.</li> <li>3. Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems</li> <li>4. Understand dispersion in waves and model dispersion using Fourier theory.</li> <li>5. Understand diffraction and imaging in terms of Fourier optics and gain physical and intuitive insight in a range of physics via the spatial Fourier Transform.</li> <li>6. Understand optical phenomena such as polarisation, birefringence, interference and diffraction in terms of the wave model.</li> </ol>	

## WAVES AND OPTICS LAB

<b>Name of the Course</b>	<b>PHYSICS-DSC 1D LAB: WAVES AND OPTICS (Credits: -02)</b>
Code	PHYS 202PR
<b>Course Outcomes</b> Through the lab course, understand the principles of measurement and error analysis and develop skills in experimental design.	

## SKILL ENHANCEMENT COURSE (Any four) (Credit: 04 each)- SEC1 to SEC4

### B.SC. 2<sup>nd</sup> Year(SEC)

#### PHYSICS WORKSHOP SKILL - SEC1

<b>Name of the Course</b>	<b>PHYSICS – SEC1: PHYSICS WORKSHOP SKILL(Credits: Theory-03)+(Credits: -01Project)</b>
Code	PHYS203TH
<b>Course Outcomes</b> <ol style="list-style-type: none"> <li>1. Aim of this course is to create awareness among the students about the mechanical, electrical and electronic tools through hands-on activities.</li> <li>2. This course introduces the students to the workshop skills like cutting, drilling, filing, different types of AC and DC generators, soldering- desoldering of electrical and electronics components, constructing regulated power supplies, etc.,</li> <li>3. After completing this course students will gain skills of using various workshop tools and also to find faults and general troubleshoots and wiring faults.</li> </ol>	

## ELECTRICAL CIRCUITS AND NETWORK SKILLS – SEC2

Name of the Course	<b>PHYSICS-SEC1/ SEC2: ELECTRICAL CIRCUITS AND NETWORK SKILLS (Credits: Theory-03)+(Credits: -01Project)</b>
Code	PHYS205TH
<b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. To know the concept of study of measurement.</li><li>2. To gain the knowledge of electrical and electronic skill.</li><li>3. To study of introduction of prime mover(machine).</li><li>4. To study of use bread board for designing the basic</li></ol>	

### B.Sc. 3<sup>rd</sup> Year

#### ELEMENTS OF MODERN PHYSICS

Name of the Course	<b>PHYSICS-DSE 1A: ELEMENTS OF MODERN PHYSICS (Credits: Theory-04)Theory</b>
Code	PHYS301TH
<b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. To know the concept and study of Quantum theory and its importance.</li><li>2. To study the Schrodinger's wave equations for nonrelativistic particles and physical significance.</li><li>3. To study the application's Schrodinger's equations</li><li>4. To know the concept and study of Nucleus Stability.</li><li>5. To study of radioactivity and emission of <math>\alpha</math>, <math>\beta</math> and <math>\gamma</math>ray.</li></ol>	

#### ELEMENTS OF MODERN PHYSICSLAB

Name of the Course	<b>PHYSICS-DSE 1A LAB: ELEMENTS OF MODERN PHYSICS (Credits: -02)</b>
Code	PHYS301PR
<b>Course Outcomes</b> <p>In this course students would be able to understand Basic experiments of modern physics such as: Determination of Plank's and Boltzmann's constants, Determination of ionization potential, Wavelength of H-spectrum, Single and double slit diffraction, Photo electric effect and determination of e/m.</p>	

#### NUCLEAR AND PARTICLE PHYSICS

Name of the Course	<b>PHYSICS-DSE 1B: NUCLEAR AND PARTICLE PHYSICS (Credits: Theory-05, Tutorials-01)</b>
Code	PHYS304TH
<b>Course Outcomes</b> <ol style="list-style-type: none"><li>1. To study of general properties nuclei.</li><li>2. To know the concept of nuclear model.</li><li>3. To understand the concept of nuclear reaction</li><li>4. To study of interaction of nuclear radiation with matter.</li></ol>	

5. To study of detector for nuclear radiations.
6. To know the concept of particle accelerators and particle Physics.

## **B.Sc. 3<sup>rd</sup> Year(SEC)**

### **RADIATION SAFETY – SEC3**

<b>Name of the Course</b>	<b>PHYSICS-SEC3: RADIATION SAFETY (Credits: Theory-03)+(Credits: -01Project)</b>
Code	PHYS307TH
<b>Course Outcomes</b>	
Upon completion, successful students will be able to:	
<ol style="list-style-type: none"> <li>1. Obtain basic information of radiation safety including understanding basic principles of ionizing radiation, the risks of working with radioactive materials/radiation producing machines etc.</li> <li>2. Obtain relevant information to work safely and confidently with radiation sources while maintaining the professional standard of ALARA.</li> <li>3. Understand typical everyday radiation safety topics, how radiation safety programs are implemented in a university, research, and or hospital setting.</li> <li>4. Obtain an in-depth understanding of a student-selected radiation protection topic through an independent study project</li> </ol>	

### **RENEWABLE ENERGY AND ENERGY HARVESTING - SEC4**

<b>Name of the Course</b>	<b>PHYSICS-SEC4: RENEWABLE ENERGY AND ENERGY HARVESTING (Credits: Theory-03)+(Credits: -01Project)</b>
Code	PHYS310TH
<b>Course Outcomes</b>	
<ol style="list-style-type: none"> <li>1. To understand the different kinds of Energy sources.</li> <li>2. To study the basis of solar energy and solar radiation measurement.</li> <li>3. To learn the fundamental principles and theory of wind energy conversion system.</li> <li>4. Student will acquire enough knowledge about the renewable energy resources.</li> <li>5. This course helps the student to understand the concepts of energy sources and their technologies.</li> <li>6. To learn the environmental pollution and climate change.</li> <li>7. To understand the basic need of carbon free energy .and student will acquire enough knowledge about the renewable energy sources.</li> </ol>	