

## Department of Physics

### Course Outcome:

#### Semester I

##### 1. Course Code: DSC 1/Minor 1

Course Name: Basic Physics I

(Minor I is offered to students of other programmes)

After completion of this course (Theory and Practical) students will

##### A. Mathematical Physics

- Get acquainted with the basic mathematical concepts required to understand Physics.
- Learn to solve differential equations often appeared in Physics.
- Learn vector algebra and the coordinate systems.

##### B. Classical Mechanics

- Get acquainted with classical Newtonian mechanics and are able to solve related physical problems.
- Learn dynamics of system of particles; collision problems.
- Learn theories of central force and related problems.
- Learn theories of fluid dynamics.

In Laboratory class the students will

- Able to use basic measuring instruments: Vernier Caliper, Screw Gauge, Travelling Microscope etc.
- Able to measure height using sextant
- Able to measure moment of inertia
- Able to measure elastic modulus
- Able to measure coefficient of viscosity of liquid

##### 2. Course Code: SEC I

Course Name: Introduction to Computer Programming and Graph Plotting

This is a laboratory course where students will learn to use computer and software to solve Physics problems and their graphical presentation.

- Learn graph plotting using GNUPLOT.
- Learn Python programming to solve basics mathematical problems.

### **3. Course Code: IDC (Interdisciplinary)**

**Course Name: Frontiers in Physics**

**(This course is offered to students of other programmes)**

After completion of this course students will

- Get basic idea of scientific and logical methods and are able to differentiate science from pseudoscience.
- Get idea about the Universe: Its origin and evolution
- Learn Energy and Matter and interactions.
- Learn basics of kinetic theory and thermodynamics.
- Learn the historical development of laws of physics from classical to quantum.

## **Semester II**

### **4. Course Code: DSC 2/Minor 2**

**Course Name: Basic Physics II**

**(Minor 2 is offered to students of other programmes)**

After completion of this course (Theory and Practical) students will

#### **A. Basic Electricity and Magnetism**

- Able to comprehend Electrostatics and can solve electric field and potential problems
- Able to comprehend Magnetostatics and can solve related field and potential problems
- Get basic idea of magnetism

#### **B. Introduction to Thermodynamics**

- Build the concepts of kinetic theory of gasses

- Get acquainted with thermodynamic parameters; able to understand thermodynamic laws and heat flow
- Able to solve thermodynamic and heat flow problems
- Build the basic concept of entropy

In Laboratory class the students will

- Get acquainted with electrical measuring devices: Ammeter, voltmeter, their connections and applications in electrical circuit and the method of inter-conversion
- Learn to use meter bridge, Carey Foster bridge, potentiometer and the method to measure small resistance
- Learn the method to measure thermal expansion coefficient of solid

## **5. Course Code: SEC II**

**Course Name: Scientific Writing Skills (Latex)**

This is a laboratory course where students will develop scientific writing skills using Latex.

- Learn the fundamentals and rules of Latex and the syntax and its use in writing scientific articles.
- Learn Python programming to solve basics mathematical problems.

## **6. Course Code: IDC (Interdisciplinary)**

**Course Name: Frontiers in Physics**

**(This course is offered to students of other programmes)**

After completion of this course students will

- Get basic idea of scientific and logical methods and are able to differentiate science from pseudoscience.
- Get idea about the Universe: Its origin and evolution
- Learn Energy and Matter and interactions.
- Learn basics of kinetic theory and thermodynamics.
- Learn the historical development of laws of physics from classical to quantum.

## Semester III

### 7. Course Code: DSC 3

#### Course Name: Waves and Optics

After completion of this course (Theory and Practical) students will

- Learn theory of oscillations: Simple harmonic, damped and forced vibration and the idea of superposition of harmonic oscillations
- Get the idea of waves: Different kinds of waves and their nature
- Build the concept of superposition of waves, formation of standing waves and the application in plucked and struck string
- Get basic idea of geometrical optics
- Learn the theory of wave optics: Interference, Diffraction and Polarization

In Laboratory class the students will

- Learn to use spectrometer and its applications in measuring wavelength of light by different techniques
- Learn to measure wave length of light by interference technique using Fresnel's bi-prism and Newton's ring.
- Learn to measure wave length of light by diffraction technique using spectrometer and grating
- Learn to use polarimeter to measure specific rotation of optically active material

### 8. Course Code: DSC 4

#### Course Name: Mathematical Physics I

After completion of this course (Theory and Practical) students will

- Learn power series and its application to solve problems in different branches of Physics
- Learn Fourier series analysis and Fourier Transform
- Get acquainted with partial differential equations and its applications
- Learn the concept of probability and its applications in Physics

- Learn Dirac delta function and some special functions used in Physics
- Learn the techniques of numerical analysis

In Laboratory class the students will

- Learn to use **numpy** and its applications to solve matrix operation, numerical solutions like Lagrange's interpolation, trapezoid and Simpson's 1/3 rule
- Learn to solve ordinary differential equations using Runge-Kutta method
- Learn to use **pyplot** to draw graphs

## 9. Course Code: SEC III

**Course Name: Introduction to data analysis**

After completion of this course (Theory and Practical) students will

- Learn the method of data analytics: Sampling, Scaling, Grouping and the method of statistical analysis
- Learn **Pandas** and its applications in data analysis
- Learn to use **numpy** and its applications in numerical computing
- Learn **matplotlib** and **seaborn** for graph plotting and visualization of data

## Semester IV

### 10. Course Code: DSC 5

**Course Name: Modern Physics**

After completion of this course (Theory and Practical) students will

- Learn basic theory of Black body radiation and its nature
- Learn basics of quantum mechanics and uncertainty principle
- Learn Schrodinger equation and its application in potential box problem, quantum tunneling,
- Learn quantum theory of Simple harmonic oscillator

In Laboratory class the students will

- Learn to measure Planck's constant using LED
- Learn to determine e/m using bar magnet

- Study photoelectric effect
- Study I-V characteristics of tunnel
- Study laser diffraction using grating

### **11.Course Code: DSC 6**

#### **Course Name: Electromagnetism**

After completion of this course (Theory and Practical) students will

- Learn the theory of alternating current, its measurement and applications
- Learn the theory of electrostatics and the problem solving methodologies: potential and field problems, method of images, boundary value problems
- Learn the theory of magnetostatics and the problem solving methodologies
- Learn dielectric properties and magnetic properties of matter
- Learn the theory of electromagnetism
- Learn Maxwell's equations and its applications in electromagnetic wave propagation in unbounded and bounded media.

In Laboratory class the students will

- Study electrical resonance in LCR circuit
- Study mutual inductance
- Study earth's magnetic field using magnetometer
- Study Malus's law using pair of polaroids
- Study to verify Fresnel's equation using prism and polaroids

### **12.Course Code: DSC 7**

#### **Course Name: Mathematical Physics II**

After completion of this course (Theory and Practical) students will

- Learn to solve second order differential equations and power series solution
- Study linear vector space and related problems
- Learn vector and tensor analysis
- Learn matrix algebra and its applications in Physics problems
- Learn methods of numerical analysis to solve partial differential equations

In Laboratory class the students will

- Learn **scipy** for solving first and second order differential equations
- Learn to solve improper integrals, Gaussian integrals by numerical methods using **scipy**
- Learn to determine Fourier coefficients using **scipy**
- Learn to solve partial differential equations, wave equations, heat flow equations, Laplace equations using **scipy**

### **13.Course Code: DSC 8**

**Course Name: Classical Mechanics and Special theory of relativity**

After completion of this course (Theory and Practical) students will

- Study non-inertial system and rotational system, rigid body problem
- Learn variational calculus to study mechanics and fluctuation
- Learn Special theory of relativity and concept of space-time

In Laboratory class the students will

- Determine moment of inertia of a fly wheel
- Determine Young's modulus by the method of Flexure
- Determine elastic modulus by Searle's method
- Determine acceleration due to gravity using bar pendulum
- Study to simple pendulum and its modeling using Tracker's software