

## **PROGRAMME: B.Sc. PHYSICS**

### **Programme Outcomes**

- PO1:** Acquire adequate knowledge of the subject
- PO2:** Craft a foundation for higher learning
- PO3:** Be initiated into the basics of research
- PO4:** Imbibe sound moral and ethical values
- PO5:** Become conscious of environmental and societal responsibilities
- PO6:** Attain skills for communication and career
- PO7:** Learn to tolerate diverse ideas and different points of view
- PO8:** Become empowered to face the challenges of the changing universe

## **PROGRAMME: B.Sc. PHYSICS**

### **Programme Specific Outcomes**

**PSO1:** Understand the basic concepts of methodology of science and the fundamentals of mechanics, properties of matter and electrodynamics

**PSO2:** Understand the theoretical basis of quantum mechanics, relativistic physics, nuclear physics, optics, spectroscopy, solid state physics, astrophysics, statistical physics, photonics and thermodynamics

**PSO3:** Understand and apply the concepts of electronics in the designing of different analog and digital circuits

**PSO4:** Understand the basics of computer programming and numerical analysis

**PSO5:** Apply and verify theoretical concepts through laboratory experiments

### **Abbreviations used:**

**CL** – Cognitive level; **U** – understand; **Ap** – apply; **An** – analyze; **C** - create

**KC** – Knowledge category; **C** – conceptual; **F** – factual; **P** - procedural

## Course Outcomes

### CORE COURSES:

#### SJPHY1B01: METHODOLOGY OF SCIENCE AND BASIC MECHANICS

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the features, methods and limitations of science	PSO1	U	C
<b>C02</b>	Understand and apply the basic concepts of Newtonian Mechanics to physical systems	PSO1	Ap	C, P
<b>C03</b>	Understand and apply the basic idea of work-energy theorem to physical systems	PSO1	Ap	C,P
<b>C04</b>	Understand and apply the rotational dynamics of rigid bodies	PSO1	Ap	C,P
<b>C05</b>	Understand the basic ideas of elasticity	PSO1	U	C

#### SJPHY2B02: MECHANICS

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the features of non-inertial systems and fictitious forces	PSO1	U	C
<b>C02</b>	Understand and analyze the features of central forces with respect to planetary motion	PSO1	An	C, P
<b>C03</b>	Understand the basics ideas of harmonic oscillations	PSO1	U	C
<b>C04</b>	Understand and analyze the basics concepts of wave motion	PSO1	An	C,P

**SJPHY3B03: ELECTRODYNAMICS I**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand and apply the fundamentals of vector calculus	PSO1	Ap	C
<b>C02</b>	Understand and analyze the electrostatic properties of physical systems	PSO1	An	C, P
<b>C03</b>	Understand the mechanism of electric field in matter	PSO1	U	C,P
<b>C04</b>	Understand and analyze the magnetic properties of physical systems	PSO1	An	C,P
<b>C05</b>	Understand the mechanism of magnetic field in matter	PSO1	U	C,P

**SJPHY4B04: ELECTRODYNAMICS II**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the basic concepts of electrodynamics	PSO1	U	C
<b>C02</b>	Understand and analyze the properties of electromagnetic waves	PSO1	An	C, P
<b>C03</b>	Understand the behavior of transient currents	PSO1	U	C
<b>C04</b>	Understand the basic aspects of ac circuits	PSO1	An	C,P
<b>C05</b>	Understand and apply electrical network theorems	PSO1	Ap	C,P

## SJPHY5B06: COMPUTATIONAL PHYSICS

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the Basics of Python programming	PSO4	U	C
<b>CO2</b>	Understand the applications of Python modules	PSO4	U	C
<b>CO3</b>	Understand the basic techniques of numerical analysis	PSO4	U	C
<b>CO4</b>	Understand and apply computational techniques to physical problems	PSO4	Ap	C,P

## SJPHY5B07: QUANTUM MECHANICS

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the particle properties of electromagnetic radiation	PSO2	U	C
<b>CO2</b>	Describe Rutherford – Bohr model of the atom	PSO2	U	C
<b>CO3</b>	Understand the wavelike properties of particles	PSO2	U	C
<b>CO4</b>	Understand and apply the Schrödinger equation to simple physical systems	PSO2	Ap	C,P
<b>CO5</b>	Apply the principles of wave mechanics to the Hydrogen atom	PSO2	Ap	C,P

**SJPHY5B08: OPTICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the fundamentals of Fermat's principles and geometrical optics	PSO2	U	C
<b>C02</b>	Understand and apply the basic ideas of interference of light	PSO2	Ap	C, P
<b>C03</b>	Understand and apply the basic ideas of diffraction of light	PSO2	Ap	C, P
<b>C04</b>	Understand the basic ideas of polarization of light	PSO2	U	C
<b>C05</b>	Describe the basic principles of holography and fibre optics	PSO2	U	C

**SJPHY5B09: ELECTRONICS (ANALOG & DIGITAL)**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the basic principles of rectifiers and dc power supplies	PSO3	U	C
<b>C02</b>	Understand the principles of transistor	PSO3	U	C
<b>C03</b>	Understand the working and designing of transistor amplifiers and oscillators	PSO3	Ap	C, P
<b>C04</b>	Understand the basic operation of Op – Amp and its applications	PSO3	U	C
<b>C05</b>	Understand the basics of digital electronics	PSO3	U	C

## **SJPHY6B10: THERMODYNAMICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the zero and first laws of thermodynamics	PSO2	U	C
<b>C02</b>	Understand the thermodynamics description of the ideal gas	PSO2	U	C
<b>C03</b>	Understand the second law of thermodynamics and its applications	PSO2	U	C, P
<b>C04</b>	Understand the basic ideas of entropy	PSO2	U	C
<b>C05</b>	Understand the concepts of thermodynamic potentials and phase transitions	PSO2	U	C

## **SJPHY6B11: STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY & PHOTONICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>C01</b>	Understand the basic principles of statistical physics and its applications	PSO2	U	C
<b>C02</b>	Understand the basic aspects of crystallography in solid state physics	PSO2	U	C
<b>C03</b>	Understand the basic elements of spectroscopy	PSO2	U	C
<b>C04</b>	Understand the basics ideas of microwave and infra red spectroscopy	PSO2	U	C
<b>C05</b>	Understand the fundamental ideas of photonics	PSO2	U	C

## **SJPHY6B12: NUCLEAR PHYSICS AND PARTICLE PHYSICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic aspects of nuclear structure and fundamentals of radioactivity	PSO2	U	C
<b>CO2</b>	Describe the different types of nuclear reactions and their applications	PSO2	U	C, P
<b>CO3</b>	Understand the principle and working of particle detectors	PSO2	U	C, P
<b>CO4</b>	Describe the principle and working of particle accelerators	PSO2	U	C, P
<b>CO5</b>	Understand the basic principles of elementary particle physics	PSO2	U	C

## **SJPHY6B13: RELATIVISTIC MECHANICS AND ASTROPHYSICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the fundamental ideas of special relativity	PSO2	U	C
<b>CO2</b>	Understand the basic concepts of general relativity and cosmology	PSO2	U	C
<b>CO3</b>	Understand the basic techniques used in astronomy	PSO2	U	C
<b>CO4</b>	Describe the evolution and death of stars	PSO2	U	C
<b>CO5</b>	Describe the structure and classification of galaxies	PSO2	U	C



**SJPHY6B14 (EL1): BIOMEDICAL PHYSICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic principles of biophysics	PSO2	U	C
<b>CO2</b>	Understand the fundamentals of medical instrumentation	PSO2	U	C
<b>CO3</b>	Understand the principles of ultrasound and x-ray imaging	PSO2	U	C
<b>CO4</b>	Understand the basic principles of NMR	PSO2	U	C
<b>CO5</b>	Describe the applications of lasers in medicine	PSO2	U	C

**SJPHY6B14 (EL2): NANOSCIENCE AND TECHNOLOGY**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the elementary concepts of nanoscience	PSO2	U	C
<b>CO2</b>	Understand the electrical transport mechanisms in nanostructures	PSO2	U	C
<b>CO3</b>	Understand the applications of quantum mechanics in nanoscience	PSO2	U	C
<b>CO4</b>	Understand the fabrication and characterization techniques of nanomaterials	PSO2	U	C
<b>CO5</b>	Enumerate the different applications of nanotechnology	PSO2	U	C

**SJPHY6B14 (EL3): MATERIALS SCIENCE**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic ideas of bonding in materials	PSO2	U	C
<b>CO2</b>	Describe crystalline and non crystalline materials	PSO2	U	C
<b>CO3</b>	Understand the types of imperfections and diffusion mechanisms in solids	PSO2	U	C
<b>CO4</b>	Describe the different properties of ceramics and polymers	PSO2	U	C
<b>CO5</b>	Describe the different types of material analysis techniques	PSO2	U	C

**SJPHY4B05: PRACTICAL I**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Apply and illustrate the concepts of properties of matter through experiments	PSO5	Ap	P
<b>CO2</b>	Apply and illustrate the concepts of electricity and magnetism through experiments	PSO5	Ap	P
<b>CO3</b>	Apply and illustrate the concepts of optics through experiments	PSO5	Ap	P
<b>CO4</b>	Apply and illustrate the principles of electronics through experiments	PSO5	Ap	P

**SJPHY6B15: PRACTICAL II**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Apply and illustrate the concepts of properties of matter through experiments	PSO5	Ap	P
<b>CO2</b>	Apply and illustrate the concepts of electricity and magnetism through experiments	PSO5	Ap	P
<b>CO3</b>	Apply and illustrate the concepts of optics and spectroscopy through experiments	PSO5	Ap	P
<b>CO4</b>	Apply and illustrate the principles of heat through experiments	PSO5	Ap	P

**SJPHY6B16: PRACTICAL III**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Apply and illustrate the principles of semiconductor diode and transistor through experiments	PSO5	Ap	P
<b>CO2</b>	Apply and illustrate the principles of transistor amplifier and oscillator through experiments	PSO5	Ap	P
<b>CO3</b>	Apply and illustrate the principles of digital electronics through experiments	PSO5	Ap	P
<b>CO4</b>	Analyze and apply computational techniques in Python programming	PSO5	Ap	P

**SJPHY6B17(P) – PROJECT**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand research methodology	PSO1	U	P
<b>CO2</b>	Understand and formulate a research project	PSO1	C	P
<b>CO3</b>	Design and implement a research project	PSO1	C	P
<b>CO4</b>	Identify and enumerate the scope and limitations of a research project	PSO1	C	P

**SJPHY6B17(R): RESEARCH METHODOLOGY (In lieu of Project)**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand research methodology	PSO1	U	C, P
<b>CO2</b>	Understand the concept of measurement in research	PSO1	C	C, P
<b>CO3</b>	Understand the significance and limitations of experimentation in research	PSO1	C	C, P
<b>CO4</b>	Understand and formulate a research project, ethics and responsibility of scientific research	PSO1	C	C, P

**OPEN COURSES:****SJPHY5D01(1): NON CONVENTIONAL ENERGY SOURCES**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the importance of non conventional energy sources	PSO2	U	C
<b>CO2</b>	Understand basic aspects of solar energy	PSO2	U	C
<b>CO3</b>	Understand basic principles of wind energy conversion	PSO2	U	C
<b>CO4</b>	Understand the basic ideas of geothermal and biomass energy and recognize their merits and demerits	PSO2	U	C
<b>CO4</b>	Understand the basic ideas of oceans and chemical energy resources and recognize their merits and demerits	PSO2	U	C

**SJPHY5D01(2): AMATEUR ASTRONOMY AND ASTROPHYSICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Describe the history and nature of astronomy as a science	PSO2	U	C
<b>CO2</b>	Understand the motion of earth in space and the cause of seasons	PSO2	U	C
<b>CO3</b>	Understand the basic elements of solar system	PSO2	U	C
<b>CO4</b>	Understand the elementary concepts of solar system	PSO2	U	C

**SJPHY5D01(3): ELEMENTARY MEDICAL PHYSICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic aspects of physics of nuclear medicine	PSO2	U	C
<b>CO2</b>	Recognize different bioelectric signals and their instrumentation	PSO2	U	C
<b>CO3</b>	Understand the basic elements of X-ray imaging	PSO2	U	C
<b>CO4</b>	Understand the basic elements of ultrasound imaging and its advantages and disadvantages	PSO2	U	C

## COMPLEMENTARY COURSES:

### **SJPHY1C01: PROPERTIES OF MATTER & THERMODYNAMICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic principles of elasticity	PSO1	U	C
<b>CO2</b>	Understand the concepts of surface tension	PSO1	U	C
<b>CO3</b>	Understand the aspects of viscosity	PSO1	U	C
<b>CO4</b>	Understand the basic principles of thermodynamics	PSO1	U	C

### **SJPHY2C02: OPTICS, LASER & ELECTRONICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic concepts of interference and diffraction	PSO2	U	C
<b>CO2</b>	Understand the concepts of polarization	PSO2	U	C
<b>CO3</b>	Understand the fundamentals of electronics	PSO2	U	C
<b>CO4</b>	Understand the important principles of laser physics	PSO2	U	C

**SJPHY3C03: MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic ideas of frames of reference and the principles of conservation of energy and momentum	PSO1	U	C
<b>CO2</b>	Understand the concepts of relativity	PSO1	U	C
<b>CO3</b>	Understand the basic ideas of oscillations and waves	PSO1	U	C
<b>CO4</b>	Understand the basic ideas of modern physics	PSO1	U	C

**SJPHY4C04: ELECTRICITY, MAGNETISM AND NUCLEAR PHYSICS**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Understand the basic ideas of static and current electricity	PSO2	U	C
<b>CO2</b>	Understand the concepts of magnetism	PSO2	U	C
<b>CO3</b>	Describe the fundamental concepts of nuclear physics	PSO2	U	C
<b>CO4</b>	Understand the basic ideas of cosmic rays and elementary particles	PSO2	U	C

**SJPHY4C05: PHYSICS PRACTICAL I**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>
<b>CO1</b>	Apply and illustrate the concepts of properties of matter through experiments	PSO5	Ap	P
<b>CO2</b>	Apply and illustrate the concepts of electricity and magnetism through experiments	PSO5	Ap	P
<b>CO3</b>	Apply and illustrate the concepts of optics through experiments	PSO5	Ap	P
<b>CO4</b>	Apply and illustrate the principles of electronics through experiments	PSO5	Ap	P