# UG Physics PO, PSO & CO

| B.Sc. Physics | |
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| Program Outcome | ➢ To acquire knowledge of physics by understanding basic concepts, fundamental principles and the scientific theories related to various physics phenomena and their relevance in the day-to-day life.<br>➢ To enhance the student's academic abilities, personal qualities and transferable skills which will give them an opportunity to develop as responsible citizens.<br>➢ To develop experimental skills to understand the laws and concepts of Physics.<br>➢ To acquire analytical and computational problem solving skills and to apply the theories learnt and the skills acquired to solve real time problems leading to research and development.<br>➢ To Perform job in various fields' viz. science, engineering, teaching, public service, etc. with scientific knowledge, precision, analytical mind, innovative thinking, clarity of thought and expression and systematic approach<br>➢ To produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community<br>➢ To endow the students with creative and analytical skills that will equip them to become entrepreneurs |
| Program Specific outcome | Successful completion of B.Sc. Physics Course student will be able to<br>➢ Understand the depth knowledge of various topics of Physics, Demonstrate skills and competencies to conduct wide range of scientific experiments.<br>➢ Accumulate the facts of nature and the ability to link the facts to observe and discover the laws of nature i.e. develop an understanding and knowledge of the basic Physics.<br>➢ Ability to employ critical thinking and efficient problem solving skills in all the basic areas of the subject. |

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| | ➢ Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics<br>➢ Motivate students to pursue PG courses in reputed institutes, Identify their area of interest in academic and Research & Development,<br>➢ Identify the specific job that they can pursue with the skills developed through the course of physics,<br>➢ Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc.. |
| **Physics Course outcome** | |
| **First Semester : Physics 1 (Paper 101)**<br>**MECHANICS – 1 , HEAT AND THERMODYNAMICS – 1** | |
| Course objectives | The aim of this course is to introduce the students to concepts of mechanics, heat and thermodynamics. This course will enhance the understanding of motion of objects under different conditions. The students will also acquire knowledge of behaviour of fluids under the action of heat. |
| Course outcome | ➢ Understand laws of motion and their application to various dynamical situations,<br>➢ Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation<br>➢ Students will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.<br>➢ Understand the phenomena of collisions and idea about centre of mass of a system of particles<br>➢ Learn about the measurement of surface temperature of sun and other bodies based on concept of black body radiation spectrum<br>➢ Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equitation of energies, mean free path of molecular collisions, viscosity and thermal conductivity, |

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| | ➢ Learn about the real gas equations, Van der Waal equation of state and Andrew/s isotherms,<br>➢ Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems. |
| Learning outcome | ➢ The students will have a knowledge of mechanics leading to general idea of objects in motion under different constraints.<br>➢ The students will get the picture of motion of celestial objects like planets and the required conditions for launching artificial satellites.<br>➢ Students will get to know the difference between the ideal and real gases and their practical implications.<br>➢ Study of thermodynamics gives the knowledge of basic working of heat engines and on what factors the efficiency of practical heat engines depends. |
| **First Semester : Physics 1 (Paper 102)**<br>**PRACTICAL PHYSICS – 1** | |
| Course objective | The course aims to develop the skills of performing experiments in mechanics and heat & thermodynamics |
| Course outcome | ➢ In the laboratory course, the students learn to do data analysis techniques like error analysis and graphing techniques<br>➢ To perform experiments in mechanics like determination of work done by a variable force, Atwood machine, concept of static, kinetic and rolling friction eyc..<br>➢ Determination of physical constants like coefficient of viscosity, interfacial tension and specific heat capacity.<br>➢ To perform basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, variation of thermo-emf of a thermocouple and calibration of a thermocouple |
| Learning outcome | ➢ Students will learn about the methodology of measurements and the errors involved in it.<br>➢ Learn how experiments in mechanics, heat and thermodynamics lead to measurement of physical constants and their importance. |

| Second Semester : Physics II (Paper 201)<br>MECHANICS – 2 , HEAT AND THERMODYNAMICS – 2 | |
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| Course objective | This course is an extension of first semester course of mechanics and heat & thermodynamics. This course will give an insight into the understanding of oscillatory motion and applications to simple and compound pendulums. The concept of elasticity is introduced leading to applications in civil engineering. As an extension of basics of thermodynamics introduced in previous semester, energy relations are studied. Phase transitions of first order is introduced to understand the process of change of state with heat. Under condensed matter physics, low temperature physics and liquefaction of gases and their applications are studied. |
| Course outcome | ➢ To understand the phenomena of simple harmonic motion and the properties of systems executing such motions. To learn the concepts of damping of oscillations and their effects<br>➢ To understand the principles of elasticity through the study of Young Modulus, modulus of rigidity and bulk modulus.<br>➢ To learn the concepts of first order phase transitions and equilibrium between phases<br>➢ To study different methods of achieving low temperatures leading to liquefaction of gases<br>➢ To write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions<br>➢ To describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.<br>➢ To describe special relativistic effects and their effects on the mass and energy of a moving object and to appreciate the importance of Special Theory of Relativity<br>➢ To recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems. |

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| Learning outcome | ➢ Students will get to know about the effects of undamped and damped oscillations<br>➢ Students will understand the phenomena of elasticity in the context of materials which undergo extension or bending.<br>➢ Study of phase transitions and low temperature physics provides a insight into effects of absorption of heat or removal of heat from a substance.<br>➢ The students are exposed to the basics of relative motion in the context of inertial and non inertial frames. |
| **Second Semester : Physics II (Paper 202)**<br>**PRACTICAL PHYSICS – II** | |
| Course objective | The process developing the required skills and understanding the concepts of oscillations, elasticity and phase transitions |
| Course outcome | ➢ To perform experiments related to oscillatory motion (compound pendulum, Rigid pendulum and torsional pendulum) to determine some physical parameters<br>➢ To conduct experiments on rotational dynamics (Flywheel), To study elastic properties and measure elastic constants (Young Modulus by stretching and Modulus of Rigidity by dynamic method, Searle's double bar)<br>➢ To study variation of boiling point with pressure using Clausius Clapeyron equation (experiment on phase transition) |
| Learning outcome | Students will be in a position to perform and analyse the experimental outcome of oscillations and elastic properties of materials |
| **Third Semester : Physics III (Paper 301)**<br>**ELECTRICITY and MAGNETISM** | |
| Course objectives | The course introduces the concepts of transient currents and AC circuits. The analysis of circuits using different network theorems is introduced. The concepts magnetic fields and their effects are discussed leading to few applications The electromagnetic wave concepts are dealt in detail. |
| Course outcome | ➢ To apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, etc. and their applications in electrical circuit analysis |

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| | ➢ To learn and analyse dc circuits containing passive elements like capacitors, inductors and resistors.<br>➢ To study magnetic fields and their effects on moving charges and current carrying conductors. Applications of magnetic field and their effects in the working of BG and HTG are introduced.<br>➢ To study Gauss law, Ampere law, Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields and propagation of electromagnetic waves<br>➢ To apply Kirchhoff's rules to analyse AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.<br>➢ To study the concepts of thermoelectricity and to draw thermoelectric power diagrams |
| Learning outcome | ➢ Students learn to analyse dc and ac circuits using network theorems<br>➢ By studying concepts of magnetic fields and its effects, students understand the working of magnetic instruments and their usage<br>➢ Learning the concept of electromagnetism, students get exposure to the principles of propagation of electromagnetic waves in different media and also that the light is a electromagnetic wave.<br>➢ By learning about the principles of thermoelectricity, students learn about the measurement of temperature over a wide range by a device called thermo electric thermometer. |
| **Third Semester : Physics III (Paper 302)**<br>**PRACTICAL PHYSICS – III** | |
| Course objective | Students will develop the skill of building simple dc and ac circuits and analyse network theorems. Students find the values of inductance, capacitance and resistance by constructing different bridges and by principle of resonance |
| Course outcome | ➢ To verify network theorems like Thevenin's theorem, superposition theorem and maximum power transfer theorems |

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| | ➢ To determine the values of inductance in LCR series/parallel circuits using electrical resonance<br>➢ To verify series and parallel combinations of capacitors using de Sauty's bride and to find inductance using Anderson's bridge |
| Learning outcome | ➢ In the laboratory course the students will get an opportunity to verify various network theorems leading to circuit analysis.<br>➢ Students will be able to learn about the behaviour and response of passive elements to AC and DC<br>➢ Using laws in electricity and magnetism students learn about the construction, working of various measuring instruments. |
| **Fourth Semester : Physics IV (Paper 401)**<br>**OPTICS and FOURIER SERIES** | |
| Course objectives | This course in basics of optics will enable the students to understand various optical phenomena, principles, workings and applications optical instruments. Students also learn about the functioning of laser devices. As a mathematical tool, Fourier analysis is introduced to analyse different types of waves |
| Course outcome | ➢ To learn basic principles and theories about the Huygens' wave nature of light and its application to reflection and refraction of light<br>➢ To study the principles of wave motion and superposition and explain physics of interference, diffraction and polarisation of light<br>➢ To understand the working of selected optical instruments like biprism, diffraction grating, and polarimeter<br>➢ To learn the principle of action of LASER and understand the working of some laser devices<br>➢ To study Fourier analysis and Fourier transform and analyse different waves like sine wave, square wave and sawtooth waves<br>➢ To study the principle and working of optical fibres and to learn about multimode optical fibres |
| Learning outcome | ➢ The course of optics will enable the students to understand various optical phenomena, principles, workings and applications of optical instruments |

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| | ➢ The students will also get exposed to one of the powerful tool called Laser device and their applications<br>➢ Students learn about one of the best communication mechanism called optical fibre |
| **Fourth Semester : Physics IV (Paper 402)**<br>**PRACTICAL PHYSICS – IV** | |
| Course objective | In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light, refractive index etc.. |
| Course outcome | ➢ To measure wavelength of light using principle of diffraction of laser light and to measure refractive index of water using the principle of refraction by a lens<br>➢ To study the phenomenon of interference by the formation of Newton's rings and interference by air wedge<br>➢ To determine resolving power of an optical instrument and to verify Brewster's law<br>➢ To determine focal length of combination of lenses |
| Learning outcome | ➢ Students get first hand exposure in the usage of optical instruments and study different optical phenomena like interference, diffraction and polarisation<br>➢ Students get to measure many physical values like wavelength of light, refractive index of a medium, wavelengths of different colours in white light etc.. |
| **Fifth Semester : Physics V (Paper 501)**<br>**STATISTICAL PHYSICS, QUANTUM MECHANICS – I, ATMOSPHERIC PHYSICS AND NANOMATERIALS** | |
| Course objective | The course will expose the students to behaviour of microscopic particles using statistical mechanics. Students will get to know about shortcomings in classical mechanics and introduces quantum mechanics. The students will study the dynamics of atmosphere and their effects. Study of nanomaterials exposes the students to nehaviour of materials at nano scale. |
| Course outcome | ➢ To understand the concepts of microstate, macrostate, thermodynamic probability etc..<br>➢ To study microscopic particles with their distinguishably or indistinguishably nature and conditions that lead to the three different distribution laws e.g. Maxwell-Boltzmann |

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| | distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles and their derivation.<br>➢ To study the failures of classical mechanics and the need for quantum mechanical approach to explain some of the properties like photoelectric effect, Compton effect etc..<br>➢ To learn about the dual nature of matter basically wave nature of material particles through Thomson's and Davisson-Germer experiments and to understand Heisenberg uncertainty principle and their applications<br>➢ To get good knowledge of Earth's atmosphere, its composition, effective temperature, Hydrostatic equation, atmospheric thermodynamics and atmospheric dynamics with the different forces involved<br>➢ To study Nano systems and its implications in modifying the properties of materials at the nanoscale<br>➢ To learn different synthesis techniques including top down and bottom up approaches and study the properties and applications of nanomaterials |
| Learning outcome | ➢ Students Learn the basic concepts and definition of physical quantities in classical statistics and comprehend the failure of classical statistics and need for quantum statistics<br>➢ Students learn the need for quantum mechanical approach to explain some properties of matter<br>➢ By learning atmospheric dynamics students gain knowledge of seasonal changes, trade winds, etc..<br>➢ Students develop basic understanding of nanostructured materials. |
| **Fifth Semester : Physics V (Paper 502)**<br>**PRACTICAL PHYSICS – V** | |
| Course objective | The laboratory experiments involve study of statistical behaviour of particles. Students study the quantum mechanical phenomena of few properties of matter and determination of physical constants. Students are exposed to few electronic experiments. |
| Course outcome | ➢ To learn the statistical distribution of different physical properties Monte Carlo experiment and other methods. |

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| | ➢ To analyse X-ray photograph of a crystalline material and study its structure<br>➢ To determine physical constants like Planck's constant using photocell<br>➢ To describe, understand and make measurements of various parameters to describe the physics of earth's atmosphere<br>➢ To construct electronic circuits like CE amplifier, AF/RF oscillator, regulated power supply etc.. |
| Learning outcome | ➢ Students will learn the statistical analysis of microscopic particles and their properties with some simple representative experiments.<br>➢ Students get exposure by constructing circuits to study amplification, oscillation, etc.. |
| **Fifth Semester : Physics VI (Paper 503)**<br>**ASTROPHYSICS, SOLID STATE PHYSICS AND SEMICONDUCTOR PHYSICS** | |
| Course objective | Students gain knowledge about the celestial objects and their properties. Study of solid state physics gives insight into the structure of solids (crystalline),properties of metals and semiconductors |
| Course outcome | ➢ To understand basic parameters of stars like brightness, radiant flux, luminosity, magnitude, orbits, spectral classification. H-R diagram<br>➢ To understand the evolution of stars and learn about the characteristics of white dwarfs, red giants, neutron stars and black holes<br>➢ To learn basics of crystal structure and physics of lattice dynamics<br>➢ To study classical and quantum mechanical analysis of free electron theory of metals. To study Hall effect in metals<br>➢ To comprehend the basic theory of superconductors, their classification, their properties and concept of BCS theory<br>➢ To understand the band theory of solids and study semiconductors and their properties.<br>➢ To study active elements like diodes and transistors and their properties with emphasis on diode as a regulator and transistor as an amplifier |

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| Learning outcome | ➢ Students conceptualize skills to understand basic parameters for describing the properties of stars and stellar spectra.<br>➢ The study of crystal structure and free electron theory of metals leads to understanding of properties of solid state materials<br>➢ Students gain insight into understanding of physics of insulators, semiconductor and conductors with special emphasis on semiconductors. |
| **Fifth Semester : Physics VI (Paper 504)**<br>**PRACTICAL PHYSICS – VI** | |
| Course objectives | Using the experimental data available, students learn to analyse the date to determine properties of stars. Students get first hand experience in the experimental measurement of physical parameters of metals and semiconductors |
| Course outcome | ➢ To determine the parameters of stars like luminosity, radius, mass etc.. using the experimental data. Sunspot photographs are used to determine sideral period of sun<br>➢ Using parallax method distance of objects can be measured which can be reciprocate for star distance measurements.<br>➢ To learn experimental skills to find Lorentz number and Fermi energy of a metal, Hall coefficient of a metal, Energy gap of a semiconductor etc…<br>➢ To characterize various devices namely PN junction diodes, LEDs, Zener diode, solar cells, PNP and NPN transistors. Also to construct amplifiers and oscillators using discrete components. |
| Learning outcome | Students learn to determine properties of metals, semiconductors and semiconductor devices through experimentation and study their applications |
| **Sixth Semester : Physics VII (Paper 601)**<br>**ATOMIC, MOLECULAR AND NUCLEAR PHYSICS** | |
| Course objective | Students get to understand the structure of an atom/molecule with the help of different theories. Students are exposed to nuclear physics with emphasis on nuclear decay, nuclear reactions, detectors and particle accelerators |
| Course outcome | ➢ To learn different theories proposed to understand structure of an atom leading to spectral analysis |

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| | ➢ To learn the effects of magnetic field on atomic spectra e.g Zeeman effect<br>➢ To study molecular spectra and learn about the scattering of radiation by molecules<br>➢ To calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay. Neutrinos and its properties and role in theory of beta decay.<br>➢ To understand nuclear fission and fusion as well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars. Also to understand the working of particle accelerators<br>➢ To gain knowledge on the basic aspects of particle Physics – the fundamental interactions, elementary and composite particles and the classifications of particles |
| Learning outcome | ➢ Students are exposed to understanding of atoms, molecules and also nuclei leading to the study their effects and applications.<br>➢ Students develop basic understanding of nuclear reactions and decays with help of theoretical formulations and laboratory experiments<br>➢ Students develop basic knowledge of elementary particles as fundamental constituent of matter, their properties, conservation laws during their interactions with matter |
| **Sixth Semester : Physics VII (Paper 602)**<br>**PRACTICAL PHYSICS – VII** | |
| Course objective | The course provides the students the experimental skills in the determination of atomic and molecular parameters like charge of an electron and molecular bond length. Experiments based on IC provides students with first hand exposure to verification of different logic gates |
| Course outcome | ➢ To study hydrogen spectrum which provides the calculation of wavelength of various spectral line<br>➢ To determine atomic constants like e/m of an electron by Thomson method and e by Millikan method<br>➢ To study the characteristics of GM counter and determine the half life of radioactive elements<br>➢ To analyse the molecular spectra of few compounds |

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| | ➢ To verify and design various logic gates and to construct adder and subtractor circuits |
| Learning outcome | ➢ Students are exposed to various experimental skills in using equipment related to measurement of atomic and molecular parameters and also the determination of these values.<br>➢ Students get an opportunity to design and analyse digital circuits |
| **Sixth Semester : Physics VIII (Paper 603)**<br>**ELECTRONICS, MAGNETIC MATERIALS, DIELECTRICS AND QUNTUM MECHANICS – II** | |
| Course objective | The course provides the study of electronic devices useful in technology. The basic understanding of magnetic materials and dielectric materials provides the exposure to students in understanding of behaviour of materials under the action of magnetic and electric fields respectively. Students study an extension of quantum mechanical concepts to few applications like hydrogen atom |
| Course outcome | ➢ To study operational amplifiers and knowledge of feedback concepts to inverting and non-inverting amplifiers and oscillators<br>➢ To study frequency response of filters and to study differentiator and integrator circuits<br>➢ To study number systems, logic gates and construct adders and subtractor circuits<br>➢ To gain knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss<br>➢ To study different types of dielectric polarisation and to learn about dielectric and ferroelectric properties of materials.<br>➢ To understand the theory of quantum measurements, wave packets and uncertainty principle.<br>➢ To understand the concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation etc..<br>➢ To solve problems like one dimensional box, harmonic oscillator and hydrogen atom |
| Learning outcome | ➢ Students learn about different types of operational amplifiers and their applications |

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| | ➢ By studying number system and logic gates students get exposure to design and analyse digital circuits<br>➢ Students learn the physics of different types of material like magnetic materials and dielectric materials leading to their practical applications<br>➢ Students develop an understanding of how to model a given problem such as particle in a box, hydrogen atom, simple harmonic oscillator etc |
| **Sixth Semester : Physics VIII (Paper 604)**<br>**PRACTICAL PHYSICS – VIII** | |
| Course objective | Students learn to analyse the opamp circuits to construct filters, amplifiers and oscillator circuits. Students study the magnetic and dielectric properties by measuring respective physical constants |
| Course outcome | ➢ To carry out experiments based on the theory that students have learnt, to measure dielectric constant, trace hysteresis loop, determine dipole moment, absorption coefficient of gamma rays etc..<br>➢ To construct filter circuits, inverting and non inverting circuits, and oscillators and to construct and study opamp as a differentiator and integrator |
| Learning outcome | ➢ The experiments on magnetism and dielectrics provides in depth understanding some of the physical constants that measure their properties<br>➢ Students learn to design, construct and analyse operational amplifier circuits |