DEPARTMENT OF PHYSICS (UG)

PROGRAM OUTCOME: B.Sc. Honours & General in PHYSICS

Students having an academic background of science at 10+2 level can pursue B.Sc programme in various branches. After the completion of the B.Sc degree there are various options available for the Physics students, they can pursue master degree in Science i.e. M.Sc, work in research related fields and can even look for professional job oriented courses. Often, in some reputed universities or colleges the students are recruited directly by big MNC's after the completion of the course. The student after graduating will be eligible for various government exams conducted by UPSC, SSC etc.

PROGRAM SPECIFIC OUTCOME:

Honours Course:

After successful completion of B.Sc.(Hons.) Physics Course student will be able to:

- Students are expected to acquire acore knowledge in physics, including the major premises of classical mechanics, quantum mechanics, electromagnetic theory, electronics, optics, special theory of relativity and modern physics.
- Students are also expected to develop a written and oral communication skills in communicating physics-related topics.
- Students should learn how to design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes. Not only that they are expected to have an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.
- Students will develop the proficiency in the acquisition of data using a variety of laboratory instruments and in the analysis and interpretation of such data
- Students will learn the applications of numerical techniques for modeling physical systems for which analytical methods are inappropriate or of limited utility.
- Students will realize and develop an understanding of the impact of physics and science on society.
- Apply conceptual understanding of the physics to general real-world situations.
- Describe the methodology of science and the relationship between observation and theory.
- Learn to minimize contributing variables and recognize the limitations of equipment.
- Discover of physics concepts in other disciplines such as mathematics, computer science, engineering, and chemistry.
- Develop the following experimental tools: Numerically model simple physical systems using Euler's method, curve fitting, and error analysis.
- Analyze physical problems and develop correct solutions using natural laws.

General Course:

After successful completion of B.Sc.(General) Physics Course student will be able to:

- Understand the depth knowledge of various subjects of Physics.
- Demonstrate skills and competencies to conduct wide range of scientific experiments.
- Identify their area of interest in academic and R&D.
- Perform job in various fields' viz. science, engineering, education, banking, business and public service, etc. with precision, analytical mind, innovative thinking, clarity of thought and expression, systematic approach.

COURSE OUTCOME (2017-2018):

1. **B.Sc. Honours in Physics**

SEMESTER-I [Choice Based Credit System]

Sl.No.	Name of the Subject	Nature	Outcome
C1	C1T: MATHEMATICAL PHYSICS I	Theory	The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve problems in quantum mechanics, electrodynamics and other fields of theoretical physics. Upon completion of the course, the student should be able to understand basic theory of: ➢ Vector analysis ➢ Functions of complex variables ➢ Elements of Probability theory ➢ Coordinate systems ➢ Computer architecture Successful students should be able to: ➢ Apply methods of functions of complex variables for calculations of integrals ➢ Work with vectors ➢ Work with Orthogonal Curvilinear Coordinates ➢ program in python
	C1P: MATHEMATICAL PHYSICS I	Practical	
C2	C2T: MECHANICS	Theory	Students will be able to articulate and describe: ➢ Relative motion. Inertial and non inertial reference frames ➢ Parameters defining the motion of mechanical systems and their degrees of freedom ➢ Study of the interaction of forces between solids in mechanical systems. ➢ Centre of mass and inertia tensor of mechanical systems. ➢ Application of the vector theorems of mechanics and interpretation of their results. ➢ Newton's laws of motion and conservation principles. ➢ Introduction to analytical mechanics as a systematic tool for problem solving. ➢ Special theory of relativity. ➢ Basic experiments on the above mentioned topics
	C2P: MECHANICS	Practical	
GE1	GE1T: MODERN PHYSICS	Theory	Students will be able to: ➢ Know the vocabulary and concepts of modern physics: basic special relativity and general relativity, elementary quantum mechanics, nuclear physics, and particle physics.
	GE1P: MODERN PHYSICS	Practical	

			➢ Understand the relationship between observation and theory and their use in building the basic concepts of modern physics ➢ Understand how major concepts developed and changed over time. ➢ Improve communication and cooperative learning skills. ➢ Organize a presentation on the application of modern physics to modern technology ➢ Basic experiments on Modern Physics

SEMESTER-I [Choice Based Credit System]

Sl.No.	Name of the Subject	Nature	Outcome
C3	C3T: ELECTRICITY AND MAGNETISM	Theory	The student is expected to: ➢ Obtain, through a combined theoretical and experimental approach to the subject, a fundamental understanding of electromagnetic phenomena. ➢ Learn how to analyze various problems in electromagnetism with mathematical methods involving vectors and elementary differential and integral calculus. ➢ Gain experience in analyzing problems within electromagnetism with ICT based methods. ➢ Learn experimental methods in physics.
	C3P: ELECTRICITY AND MAGNETISM	Practical	
C4	C4T: WAVE AND OPTICS	Theory	On satisfying the requirements of this course, students will have the knowledge and skills to: ➢ Understand linear, time-invariant systems. ➢ Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems ➢ Understand optical phenomena such as polarisation, birefringence, interference and diffraction in terms of the wave model ➢ Understand the foundations of fluid dynamics ➢ Through the lab course, understand the principles of measurement and error analysis and develop skills in experimental design
	C4P: WAVE AND OPTICS	Practical	
GE-2	GE2T: THERMAL PHYSICS AND STATISTICAL MECHANICS	Theory	Upon successful completion, students will have the knowledge and skills to: ➢ Identify and describe the statistical nature of concepts and laws in thermodynamics, in particular: entropy,

	GE2P: THERMAL PHYSICS AND STATISTICAL MECHANICS	Practical	temperature, chemical potential, Free energies, partition functions. ➢ Use the statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems. ➢ Apply the concepts and principles of black-body radiation to analyze radiation phenomena in thermodynamic systems. ➢ Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc. ➢ Analyze phase equilibrium condition and identify types of phase transitions of physical systems. ➢ Make connections between applications of general statistical theory in various branches of physics ➢ Design, set up, and carry out experiments; analyse data recognising and accounting for errors; and compare with theoretical predictions

PART – II (3-Tier System)

Sl.No.	Name of the Subject	Nature	Outcome
P- III	Mathematical Methods II	Theory	The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve problems in quantum mechanics, electrodynamics and other fields of theoretical physics. Upon completion of the course, the student should be able to understand basic theory of: ➢ Vector and tensor analysis. ➢ Functions of complex variables ➢ Elements of distribution theory. ➢ Fourier Series ➢ Apply methods of functions of complex variables for calculations of integrals ➢ Expand functions in Taylor's Series ➢ Expand functions in Fourier Series ➢ Work with vectors ➢ Work with tensors
	RELATIVITY	Theory	After successfully completed course, student will be able to ➢ Differentiate wrong general public ideas about the theory and what the theory is really about

			➢ Understand time – spacial relations at the local and global levels ➢ Understand the basis of Standard model ➢ Understand the gravity as bending of space-time ➢ Calculate the angle light bends under the influence of gravity ➢ Calculate the increase of wavelength of light leaving Earth. ➢ Calculate time dilation corrections used in GPS satellites due to special and general relativity. ➢ Understand the basic characteristics of black holes. ➢ Understand the basic characteristics of gravitational waves ➢ Understand the accelerated expansion of the universe in relation to Einstein's cosmological constant
	CURRENT ELECTRICITY AND MAGNETISM	Theory	Students will be able to demonstrate the following skills when analyzing situations involving electrostatic fields and potentials and their sources, currents, voltage, capacitance, power, basic electrical circuits, magnetic fields and their sources, and induction: ➢ Students will be able to conduct qualitative analysis of electromagnetism problems which demonstrates conceptual understanding as measured by performance in visualizing problems through diagrams, estimating answers, assessing and justifying answers, analyzing graphs and clear, written explanations ➢ Students will be able to perform quantitative calculations in situations involving electric and magnetic fields, and demonstrate knowledge of the relevant basic units, vector addition, and application of basic calculus
	Electromagnetic Theory	Theory	After successful completion of this course, students will be able to: ➢ Understand electric and magnetic fields and apply the principles of Coulomb's Law and Gauss's law to electric fields in various coordinate systems. ➢ Identify the electrostatic boundary-value problems by application of Poisson's and Laplace's equations. ➢ Understand the depth of static and time-varying electromagnetic field as governed by Maxwell's equations.

			➢ Formulate and analyse problems involving lossy media with planar boundaries using uniform plane waves. ➢ Apply concepts of this subject in Antenna Engineering and its applications.
	Quantum Mechanics I	Theory	This course develops concepts in quantum mechanics such that the behaviour of the physical universe can be understood from a fundamental point of view. It provides a basis for further study of quantum mechanics. Content will include: ➢ Review of the Schrodinger equation, operators, eigenfunctions, compatible observables, infinite well in one and three dimensions, degeneracy. ➢ Fourier methods and momentum space; Hermiticity. ➢ Scalar products of wave functions, completeness relations, matrix mechanics. ➢ Harmonic oscillator in one and three dimensions. ➢ Sudden approximation; central potentials, quantisation of angular momentum, separation of radial and anqular variables, spherical harmonics, hydroqen atom, spin.
P-IV	Mechanics II	Theory	After successful completion of this course, students will be able to: ➢ State the Newton's law of viscosity and Explain the mechanics of fluids at rest and in motion by observing the fluid phenomena. ➢ Compute force of buoyancy on a partially or fully submerged body and Analyze the stability of a floating body ➢ Derive Euler's Equation of motion and Deduce Bernoulli's equation. ➢ Lagrangian Mechanics ➢ Hamiltonian Formulation
	Atomic, Molecular Phys with LASER	Theory	After successful completion of this course, students will be able to: ➢ List different types of atomic spectra and related instrumentation. ➢ Describe theories explaining the structure of atoms and the origin of the observed spectra. ➢ Identify atomic effect such as space quantization and Zeeman effect. ➢ Describe the molecular bonding and molecular

			energies. ➢ Memorize different technique used in laser and applications
	Electronics II	Theory	After successful completion of the course student will be able to: ➢ Design and analyze the basic operations of MOSFET. ➢ Know about the multistage amplifier using BJT and FET in various configuration to determine frequency response and concept of voltage gain. ➢ Know about different power amplifier circuits, their design and use in electronics and communication circuits. ➢ Know the concept of feedback amplifier and their characteristics. ➢ Design the different oscillator circuits for various frequencies.
	Nuclear Physics I	Theory	After successful completion of the course student will be able to: ➢ express the basic concepts of nuclear physics. ➢ express the radioactive decays. ➢ express the alpha decay. ➢ express the beta decays. ➢ express the gamma decay. ➢ express nuclear binding energy and nuclear masses. ➢ explain nuclear fission. ➢ explain nuclear fusion.
P-V	VA. Non-electrical Practical	Practical	➢ Students will perform non-electrical experiments related to their theory syllabus.
	VB. Electrical & Electronics Practical	Practical	➢ Students will perform electrical and electronics experiments related to their theory syllabus.

PART – III (3-Tier System)

Sl.No.	Name of the Subject	Nature	Outcome
Paper-VI :	Quantum Mechanics II	Theory	By the end of the course, ➢ The students will be able to use the

			perturbation theory and variational approach to solve questions in atomic physics; ➢ The students will be able to conduct angular momentum operation and summation for orbital angular momentum and spin.
	Nuclear Physics II	Theory	On completion of this course, students should be able to: ➢ demonstrate a knowledge of fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter; ➢ discuss nuclear and radiation physics connection with other physics disciplines – solid state, elementary particle physics, radiochemistry, astronomy ➢ discuss nuclear and radiation physics applications in medical diagnostics and therapy, energetics, geology, archaeology; ➢ escribe experimental techniques used (or developed) for nuclear physics purposes (logic circuits, gamma cameras, semiconductor detectors) and discuss their influence on development of new technologies ➢ explore an application of nuclear and/or radiation physics and communicate their understanding to a group of their peers in a short presentation.
	Statistical Mechanics	Theory	On completion of this course, students should be able to: ➢ explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics; ➢ apply the principles of statistical mechanics to selected problems; ➢ apply techniques from statistical mechanics to a range of situations; ➢ use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations ➢ use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanation.
	Solid State Physics	Theory	Students should gain basic knowledge of solid state physics. This implies that the student will: ➢ be able to account for interatomic forces and

			bonds - have a basic knowledge of crystal systems and spatial symmetries ➢ be able to account for how crystalline materials are studied using diffraction, including concepts like form factor, structure factor, and scattering amplitude. ➢ know the principles of structure determination by diffraction. ➢ understand the concept of reciprocal space and be able to use it as a tool ➢ know the significance of Brillouin zones ➢ know what phonons are, and be able to perform estimates of their dispersive and thermal properties ➢ be able to calculate thermal and electrical properties in the free-electron model ➢ know Bloch's theorem and what energy bands are
Paper-VII:	VIIA. Practical: Analog electronics experiments	Practical	➢ Students will perform Analog electronics experiments related to their syllabus.
	VIIB. Practical: Digital electronics experiments	Practical	➢ Students will perform Digital electronics experiments related to their syllabus.
Paper-VIII	VIIIA. Practical: Non Electronic experiments	Practical	➢ Students will perform non-electronics experiments related to their syllabus.
	VIIIB. Computer Practical	Practical	On completion of this course, students should be able to gain knowledge about: ➢ Basic building blocks ➢ Computer soft ware- Operating system ➢ Elementary programming with Fortran
	VIIIC. Project Work	Project	➢ Students will do the project experiments, in consultation with the teacher, on any topic within the content of the theoretical syllabus

B.Sc. General in Physics

PART-1

Sl.No.	Name of the Subject	Nature	Outcome
PAPER-I	Gr.-A:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Vector Analysis. ➢ Mechanics. ➢ SHM, Simple & Compound pendulums, torsional pendulum. ➢ General Properties of Matter.
	Gr.-B:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Kinetic Theory of Gases. ➢ Thermodynamics.
	Gr.-C:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Waves. ➢ Acoustics. ➢ Geometrical Optics. ➢ Tutorials.

PART-2

Sl.No.	Name of the Subject	Nature	Outcome
Paper-II	Gr.-A:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Electrostatics. ➢ Steady electric current.
	Gr.B:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Magnetostatics. ➢ Electromagnetic induction and Maxwell's Equations. ➢ Transients in DC. ➢ Alternating current
	Gr.-C:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Physical optics. ➢ Electronics.

	Gr.-D:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Relativity. ➢ Atomic Physics. ➢ Quantum mechanics. ➢ Nuclear Physics ➢ Solid State Physics ➢ Tutorials.
PAPER-III		Practical	➢ Students will perform experiments related to their theory syllabus.

PART – 3

Sl.No.	Name of the Subject	Nature	Outcome
PAPER-IV	Gr.-A:	Theory	On completion of this course, students should be able to gain knowledge about: ➢ Mechanics and Thermodynamics. ➢ Sound and Acoustics. ➢ Electricity. ➢ LASER and Modern Optics. ➢ Electronics. ➢ Computer Hardware, Software and application. ➢ Overall tutorial.
	Gr.-B:	Practical	➢ Project-type sample experiments on any topic within the content of the theoretical syllabus (Part III Gen).