

Department of Physics

The learning outcomes-based curriculum framework (LOCF) for the undergraduate programs in Physics like B.Sc(Physics General) and B.Sc.(Honours) in Physics is intended to provide a broad framework within which both the undergraduate programs in Physics help to create an academic base that responds to the need of the students to understand the basics of Physics and its ever evolving nature of applications in explaining all the observed natural phenomenon as well as predicting the future applications to the new phenomenon with a global perspective. The curriculum framework is designed and formulated in order to acquire and maintain standards of achievement in terms of knowledge, understanding and skills in Physics and their applications to the natural phenomenon as well as the development of scientific attitudes and values appropriate for rational reasoning, critical thinking and developing skills for problem solving and initiating research which are competitive globally and are on par in excellence with the standard Higher Education Institutions (HEI) in the advanced countries of America, Asia and Europe. The multicultural fabric of our nation requires that the institutions involved in implementing this curriculum framework also work hard towards providing an environment to create, develop and inculcate rational, ethical and moral attitudes and values to help the creation of knowledge society needed for scientific advancement of our nation.

The learning outcome based curriculum framework in Physics should also allow for the flexibility and innovation in the program design of the UG education, and its syllabi development, teaching learning process and the assessment procedures of the learning outcomes. The process of learning is defined by the following steps which should form the basis of final assessment of the achievement at the end of the program.

The aims and objectives of our UG educational programs in sciences in general and Physics in particular should be structured to

- create the facilities and environment in all the educational institutions to consolidate the knowledge acquired at +2 level and to motivate and inspire the students to create deep interest in Physics, to develop broad and balanced knowledge and understanding of physical concepts, principles and theories of Physics.
- learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
- develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
- expose the student to the vast scope of Physics as a theoretical and experimental science with applications in solving most of the problems in nature spanning from 10-15 m to 1026m in space and 10-10 eV to 1025eV in energy dimensions.
- emphasize the discipline of Physics to be the most important branch of science for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas.



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- to emphasize the importance of Physics as the most important discipline for sustaining the existing industries and establishing new ones to create job opportunities at all levels of employment.

In view of opening the new windows in higher education and research and opening job opportunities at all levels from technicians to innovator scientists and engineers, two undergraduate programs are offered in our universities and other higher education institutions (HEI) at the entry level of our higher education system.

Some of the characteristic attributes of a graduate in Physics are

- **Disciplinary knowledge and skills:** Capable of demonstrating

- i. good knowledge and understanding of major concepts, theoretical principles and experimental findings in Physics and its different subfields like Astrophysics and Cosmology, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science and other related fields of study, including broader interdisciplinary subfields like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology etc. (ii) ability to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable in almost all the fields of Physics listed above in (i).
- ii. • **Skilled communicator:** Ability to transmit complex technical information relating all areas in Physics in a clear and concise manner in writing and oral ability to present complex and technical concepts in a simple language for better understanding.
- iii. • **Critical thinker and problem solver:** Ability to employ critical thinking and efficient problem solving skills in all the basic areas of Physics.
- iv. • **Sense of inquiry:** Capability for asking relevant/appropriate questions relating to the issues and problems in the field of Physics, and planning, executing and reporting the results of a theoretical or experimental investigation.
- v. • **Team player/worker:** Capable of working effectively in diverse teams in both classroom, laboratory, Physics workshop and in industry and field-based situations.
- vi. • **Skilled project manager:** Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.
- vii. • **Digitally Efficient:** Capable of using computers for simulation studies in Physics and computation and appropriate software for numerical and statistical analysis of data, and employing modern e-library search tools like Inflightnet, various websites of the renowned Physics labs in countries like the USA, Europe, Japan etc. to locate, retrieve, and evaluate Physics information.
- viii. • **Ethical awareness / reasoning:** The graduate should be capable of demonstrating ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, and adopting objectives, unbiased and truthful actions in all aspects of work. UGC Document on LOCF Physics .


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- ix. •**National and international perspective:** The graduates should be able to develop a national as well as international perspective for their career in the chosen field of the academic activities. They should prepare themselves during their most formative years for their appropriate role in contributing towards the national development and projecting our national priorities at the international level pertaining to their field of interest and future expertise.
- x. •**Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling in all areas of Physics.



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Programme Outcome

Course: B. Sc. Physics

Core Papers:

PHSGCOR01T : Mechanics : The students would learn about the behaviour of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology; especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity and special relativity.

PHSGCOR01P : Mechanics Lab :Students would perform basic experiments related to mechanics and also get familiar with various measuring instruments would learn the importance of accuracy of measurements.

PHSGCOR02T : Electricity and Magnetism : It gives an opportunity for the students to learn about one of the fundamental interactions of electricity and magnetism, both as separate phenomena and as a singular electromagnetic force. The course contains vector analysis, electrostatics, magnetism, electromagnetic induction and Maxwell's equations. The course is very useful for the students in almost every branch of science and engineering.

PHSGCOR02P : Electricity and Magnetism Lab :Students would gain practical knowledge about electricity and magnetism and measurements such as: Resistance, Voltage, current etc.

PHSGCOR03T : Thermal Physics and Statistical Mechanics :The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter. The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, theory of radiation and statistical mechanics.

PHSGCOR03P : Thermal Physics and Statistical Mechanics Lab :Students would gain practical knowledge about heat and radiation, thermodynamics, thermo emf , RTD etc. and perform various experiments.

PHSGCOR04T : : Wave and Optics :The course comprises of the study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization. The course is important for the students to make their career in various branches of science and engineering, especially in the field of photonic engineering.


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PHSGCOR04P : Wave and Optics Lab : The practical knowledge of wave motion doing experiments: Tuning fork, electric vibrations. They would also learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers.

PHSGDSE01T : Digital, Analog Circuits and Instrumentation : The students would gain the knowledge of Basic Electronics circuits, network theorems and measuring instruments: They would know about common solid state devices: Semiconductor diodes and transistors. The topics also include the Rectifiers, Filters and their applications, number systems and logic gates which are foundation blocks of digital electronics.

PHSGDSE01P : Digital, Analog Circuits and Instrumentation Lab: In this course students would be able to understand Basic experiments of Digital, Analog Circuits and Instrumentation like Logic Gates, Half Adder, Full Adder, Op-Amp 741, Multivibrator, Wien Bridge Oscillator etc.

PHSGDSE02T :Perspectives of Modern Physics:Students would know about the basic principles in the development of modern physics. The topics covered in the course build a basic foundation of undergraduate physics students to study the advance branches: quantum physics, nuclear physics, particle physics and high energy physics. The course contains the study of Planck's hypothesis, photoelectric effect, Compton effect, matter waves, atomic models, Schrodinger wave equations, and brief idea of nuclear physics.

PHSGDSE02P :Perspectives of Modern Physics Lab : 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 .

PHSGDSE03T : Solid State Physics:Students would be able to understand various types of crystal structures and symmetries and understand the relationship between the real and reciprocal space and learn the Bragg's X-ray diffraction in crystals. Would also learn about phonons and lattice.

PHSGDSE03P : Solid State Physics Lab :The course Provides practical knowledge of various physical phenomena such as: magnetism, dielectrics, ferroelectrics and semiconductors. Students would gain a hands-on learning experience by performing experiments on these properties of materials.

PHSGDSE04T : Nuclear and Particle Physics :Understand the ideas of basics of nucleus and their energy, the procedures for nuclear fission and fusion the properties of positive rays, experimental proof by frank and hertz method, the relationship between various types of couplings, basic understanding of nuclear properties and models that describe the quantum structure, decay, and reactions of nuclei, basic knowledge about the Standard Model of elementary particles and interactions.