Graduate attributes in Physics

Some of the Graduate attributes of a graduate in Physics are

- **Disciplinary knowledge and skills:** Capable of demonstrating 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.
  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 .
- **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.
- **Critical thinker and problem solver:** Ability to employ critical thinking and efficient problem solving skills in all the basic areas of Physics.
- **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.
- **Team player/worker**: Capable of working effectively in diverse teams in both classroom, laboratory, Physics workshop and in industry and field-based situations.
- **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.
- **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 Inflibnet, various websites of the renowned Physics labs in countries like the USA, Europe, Japan etc. to locate, retrieve, and evaluate Physics information.
- **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.

- **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.
- **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.

Program Learning Outcomes (POs) in B.Sc (Honours) Physics

The student graduating with the Degree B.Sc (Honours) Physics should be able to

- Acquire

  (i) a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics and interdisciplinary areas like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics,Mathematical Physics, Analytical dynamics, Space science, and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology;

  (ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service;

  (iii) skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.
- Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.
- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.
- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.
- Demonstrate relevant generic skills and global competencies such as

  (i) problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries;

(ii) investigative skills, including skills of independent investigation of Physics-related issues and problems;

(iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature;

(iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Physics and ability to translate them withpopular language when needed;

(v) ICT skills;

(vi) personal skills such as the ability to work both independently and in a group.

- Demonstrate professional behavior such as

(i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism;

(ii) the ability to identify the potential ethical issues in work-related situations;

(iii) appreciation of intellectual property, environmental and sustainability issues, constitutional values, Indian Knowledge system; and

(iv) promoting safe learning and working environment.

Discipline Specific Course for 4year
Major Course: B.Sc Physics (Hons.)

S. No.	POs	DSC-1	DSC-2	SEC-1	IDC
1	Fundamental understanding of the field	X	X	X	X
2	Application of basic Physics concepts	X	X	X	X
3	Linkages with related disciplines	X	X	X	X
4	Procedural knowledge for professional subjects	X	X	X	-
5	Skills in related field of specialization	X	X	X	-
6	Ability to use in Physics problem	X	X	X	X
7	Skills in Mathematical modeling	X	X	X	-
8	Skills in performing analysis and interpretation of data	X	X	X	-
9	Develop investigative Skills	X	X	-	-
10	Skills in problem solving in Physics and related discipline	X	X	X	-
11	Develop Technical Communication skills	X	X	X	X
12	Developing analytical skills and popular communication	X	X	X	X
13	Developing ICT skills	-	-	X	-
14	Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading,etc	X	X	X	X

Course Learning Outcomes (CLO)

DSC1: BASIC PHYSICS-I
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

Students will be able to

- Revise the knowledge of calculus, SI system, plotting, vectors, vector calculus. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.
- Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.
- Learn homogenous differential equations, partial derivatives which have applications in all branches of physics.
- Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. She will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
- Understand the dynamics of system of particles and idea about center of mass and laboratory frames and their correlation.
- Apply Kepler's law to describe the motion of planets and satellite in circular orbit,through the study of law of Gravitation, central force.
- Understand simple principles of fluid flow and the equations governing fluid dynamics.
- In the laboratory course, the student shall perform experiments to measure Modulus of Rigidity, moment of inertia, vertical height using Sextant, determining coefficient of viscosity. Know about the basic theory of errors, their analysis, estimation with examples of simple experiments in Physics

Course Learning Outcomes (CLO)

DSC2: BASIC PHYSICS-II
(Credits: 04, Theory-03, Practicals-01)

Course learning outcome (COs):

Students will be able to

- Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to various systems.
- Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electriqotential, electric potential energy) formalisms of electrostatics.
- Articulate knowledge of electrostatic energy.
- Basic knowledge of Loretnz force and operational principle of cyclotron.
- Describe the basics of magnetostatics, Bio-Savart Law.
- Application of Ampere's circuital law, concept of magnetic dipole etc.
- Learn the microscopics and macroscopic description of matter, postulates of kinetic theory of gases, Maxwell-Boltzman distribution law.
- Comprehend the basic concepts of thermodynamics, the zeroth, first and the second law of thermodynamics, the concept of entropy and the associated theorems.
- In the laboratory course the student will get an opportunity to study the conversion of Ammeter to Voltmeter and vice versa.
- Should be able to determine the unknown resistance using Carey-Foster bridge, measurement of current using potentiometer..
- Measure the pressure coefficient and coefficient of thermal expansion.

Course Learning Outcomes (CLO)

Skill Enhancement Course

SEC1: Introduction to Computer Programming and Graph Plotting (Credits: 04, Theory-0, Practicals-04)

Course learning outcome (COs):

Students will be able to

- Perform 2D graph plotting using GNUPLOT
- They will have basic idea about Python Programming, its basic operations, conditional statements, built in function etc.
- Idea about different data structures like list, tuple, string, set etc and their usage in writing programmes.
- They will be able to solve simple physical problems involving sorting, matrix operations, and differential equations as well as finding the roots of equations.

Course Learning Outcomes (CLO)

Interdisciplinary Course

IDC: Frontiers in Physics
(Credits: 03, Theory-02, Tutorial-01)

Course learning outcome (COs):

Students will be able to gain qualitative knowledge about

- Basic Nature of Science, reasoning and universality of physics experimentation.
- The Universe, its creation and evolution, celestial laws.
- Matter and its constitutions, thermodynamics and radioactivity.
- Basic laws of nature, dual property of light and introduction to quantum mechanics and relativity.