Department of Physics

Program Outcomes, Program Specific Outcomes and Course Outcomes

B.Sc. (PHYSICS)

THREE-YEAR FULL-TIME PROGRAMME (Six-Semester Course)

PROGRAMME OUTCOMES:

After successful completion of three year degree program in physics a student should be able to:
1. Demonstrate, solve and an understanding of major concepts in all disciplines of physics.
2. Develop ability to solve the problems, think methodically, independently and draw a logical conclusion.
3. Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of experiments.
4. Create an awareness of the impact of Physics on the society, and development outside the scientific community.
5. Will inculcate the scientific temperament and develop the same outside the scientific community.

Programme Specific Outcomes:

PSO-1. Gain the knowledge of Physics through theory and practicals.
PSO-2. Understand good laboratory practices and safety.
PSO-3. Develop research oriented skills.
PSO-4. Make aware and handle the sophisticated instruments/equipments.
PSO-5. Physics graduate can find ample career openings both in public as well as private sector enterprises; also can apply for all government jobs as graduation is the basic qualification.
PSO-6. One can find various opportunities in governmental organizations like DRDO, ISRO, BARC, etc.
PSO-7. The candidate can go for masters degree in various specialized areas such as: Physics , Applied Physics and Ballastics , Bio Physics , Engineering Physics , Geophysics , Marine Geo Physics , Medical Physics, Renewable Energy etc.

Course Outcomes

S. No.	Course name	Sem.	Course Outcomes
1	**Mechanics and General Properties of Matter**	**I**	1. To understand the basics of vector analysis and vector operators. 2. To gain the knowledge of Gravitational field and potentials and related problem solving techniques. 3. To study various Conservation Laws. 4. To study the basics of dynamics of rigid bodies and concepts of moment of Inertia **.** 5. To understand the basic properties of solids and liquids.
2	**Electricity and Magnetism**	**I**	1. To study the concept of electric field and potential and develop related problem solving abilities. 2. To understand the effects of electric and magnetic fields in matter. 3. To study theories and circuit analysis related to AC and DC electric Currents. 4. To develop understanding of various laws related to magnetic fields and to derive field and potential due to various current distributions. 5. To understand the concepts of electromagnetic induction.
3	**Practical**	**I**	1. To get familiar with taking observations and data presentation. 2. To apply and illustrate the concepts of properties of matter through experiments. 3. To apply and illustrate the concepts of electricity and magnetism through experiments. 4. To gain hands on exposure to various experiments.
4	**Theory of Oscillations**	**II**	1. To understand the basics of simple harmonic motion and simple systems exhibiting SHM. 2. To gain the knowledge of over, critical and under damped SHM and related problems. 3. To study forced oscillations and resonance. 4. To study the applications of SHM in understanding compound pendulum, Torsional pendulum and LC circuits.
5	**Waves, Acoustics and Electromagnetic Waves**	**II**	1. To get familiar with analysis of wave motion using mathematical formulation. 2. To gain the knowledge of ultrasonics, their production and applications. 3. To study acoustics, measurement of acoustics intensity and characteristics of musical sound. 4. To study basics of electromagnetic waves.
6	**Practical**	**II**	1. To get familiar with taking observations and data presentation. 2. To apply and illustrate the concepts of properties of matter through experiments. 3. To apply and illustrate the concepts of electricity and magnetism through experiments. 4. To gain hands on exposure to various experiments.
7	**Heat and**	**III**	1.To study basic concepts of thermodynamics and laws of

	Thermodynamics		thermodynamics. 2. To understand the physical significance of thermodynamical potentials. 3. To Comprehend the kinetic model of gases w.r.t. various gas laws. 4. To study the Modes of heat transfer namely Conduction, Convection and Radiation.
8	**Geometrical Optics**	**III**	1. To study Fermat's Principle of Extremum Path and understand fundamental physics behind reflection and refraction of light. 2. To understand the theory of image formation by an optical system. 3. To study of different types of optical Aberrations and techniques for their reduction. 4. To study of different types of optical instruments used in industry and research.
9	**Practical**	**III**	1. To study and determine the optical and thermal properties by performing various experiments. 2. To learn measurement precision and through Lab Experiments.
10	**Physical Optics**	**IV**	1. To study Interference of light by division of wavefront and division of amplitude. 2. To Understand Diffraction of Light and concept of Zone Plate. 3. To Understand the polarization of light. 4. To Study of different types of associated optical instruments based on interference and diffraction of light which are widely used in industry and research.
11	**Elementary Solid State Physics and Statistical Physics**	**IV**	1. To study crystal structure and get familiarize with the concept of reciprocal lattice. 2. To understand Lattice Vibration and thermal Properties of Solids. 3. To get familiar with band theory of solids and classification of materials into conductors, insulators and semiconductors. 4. to study the basic concepts of statistical physics.
12	**Practical**	**IV**	1. To study and determine the optical and thermal properties by performing various experiments. 2. To learn measurement precision and through Lab Experiments.
13	**Quantum Mechanics and Special Relativity**	**V**	1. To study a systematic evolution of quantum theory and related experimental evidences. 2. To familiarize with Operator Formulation of Quantum Mechanics. 3. To understand the wave formulation and Schrödinger's equation. 4. To understand the basics of special theory of relativity
14	**Network Analysis, Solid State Devices and Basic Electronics**	**V**	1. To study different Network Theorems for simplifying complicated electronics circuits. 2. To study Regulated Power Supply and understand

			different types of Rectifiers, Filters and Voltage Regulator. 3. To study different types of special purpose diodes and their applications 4. To understand the fundamentals of Transistors and their applications in different types of Amplifiers.
15	**Practical**	**V**	1. To study electronic device fundamentals by performing various experiments. 2. To learn measurement precision and through Lab Experiments.
16	**Modern Physics**	**VI**	1. To study different atomic models and related concepts. 2. To understand the fundamental concepts of optical spectra and X- rays. 3. To understand the theory and applications of LASERS. 4. To understand fundamentals of molecular spectroscopy. 5. To study the structure of atomic nucleus and radioactive decay.
17	**Analog and Digital Electronics**	**VI**	1. To study fundamentals of feedback in amplifiers and design of various types of amplifiers. 2. To study classification of different types of oscillators and understand their working. 3. To introduce the concepts of Boolean Algebra and various number systems 4. To study of logic gates and their applications.
18	**Practical**	**VI**	1. To study electronics device fundamentals and concepts of modern physics by performing various experiments. 2. To learn measurement precision and through Lab Experiments.

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Program Outcomes, Program Specific Outcomes and Course Outcomes

M.Sc. (PHYSICS)
TWO-YEAR FULL-TIME PROGRAMME
(Four-Semester Course)
Science Faculty

PROGRAMME OUTCOMES:
After successful completion of three year degree program in physics a student should have knowledge of advanced concepts of Physics and ability to apply this knowledge in various fields of academics, research and industry. They may pursue their future career in the field of academics, research and industry.

PO1 Competence in the methods and techniques of calculations using Mathematical Physics, Classical Mechanics, Quantum Mechanics and Communication Electronics. It will develop an analytical skill on an advanced level and will enable the student to have mathematical tools to solve complex problems of Physics. The Programme will motivate the student to know more about the matter, the universe and the recent developments in the field of science. The student will have adequate knowledge to work for the industry,, consultancy, education, and research.

PO2 The students would gain substantial knowledge in various branches of physics. The programme will enable the student to explore more in the field of his/her choice like Advanced Electronics, Spectroscopy, Astrophysics and High energy Physics. The student will be well equipped with the knowledge required for different organizations, industry, R& D sector.

Programme Specific Outcomes:

PSO 1. The Master of Science in Physics programme provides student the adequate knowledge to use mathematical tools to solve complex physical problems and have the solid background and experience needed to analyze and solve advanced problems in physics.

PSO 2. This course would enable the student to acquire scientific skills and the practical knowledge by performing experiments in general physics and electronics.

PSO 3. The student would also get some research oriented experience by doing theoretical and experimental projects in the last semester under the supervision of faculty.

PSO 4. The course as a whole opens up several career options for the students interested in various areas of science and technology in private, public and government sectors. Students may get job opportunities in higher education, research organizations, physics consultancy and many

others. Some of the institutions where physics students can start their career are: BARC, DRDO, NPTC, IISc, ISRO, ONGC, BHEL, PRL, NPL, SINP, VECC, IITs, NITs, IIPR etc.

Course Outcomes

S. No.	Course	Sem.	Course Outcomes
1	Paper 1: Mathematical Methods (PHY-4911)	**I**	Students would be able to understand the mathematical methods essential for solving the advanced problems in physics. It would be helpful in the development of the ability to apply the mathematical concepts and techniques to solve the problems in theoretical and experimental physics. The knowledge of mathematical physics would be beneficial in further research and development as it serves as a tool in almost every branch of science and engineering Course.
2	Paper 2: Classical Mechanics (PHY-4912)	**I**	In this course students would learn to apply the Newtonian laws using various mathematical formulations to describe the motions of macroscopic objects using generalized coordinates, momentum, forces and energy. The classical mechanics would be helpful in understanding of advanced branches of modern physics.
3	Paper 3: Quantum Mechanics (PHY-4913)	**I**	The course provides an understanding of the behaviour of the systems at microscopic (atomic and nuclear) scale and even smaller. Students would learn basic postulates and formulations of quantum Mechanics. The course, in fact, plays an important role in explaining the behaviour of all physical systems in the universe. The course includes the study of a brief review of foundations of quantum mechanics, matrix formulation of quantum mechanics, symmetry in quantum mechanics and approximation methods for bound states.
4	Paper 4: General Theory of Relativity and Cosmology (PHY-4914)	**I**	Develop familiarity with the basic techniques of Riemannian geometry. • Get an understanding of the notion of spacetime in the framework of special relativity and General relativity • Learn techniques of relativity like calculation of geodesics and curvature and study the Schwarzschild solution of Einstein's equation in details • Apply general theory of Relativity to the cosmological problem and study the dynamics and kinematics of an expanding Homogeneous and Isotropic Universe
5	Paper 5: Communication Electronics (PHY-4915)	I	This course helps the student to gain basic ideas of the fundamentals of communication systems. The course includes Modulation AM and FM (Transmission and reception), SSB transmission, AM detection, AGC, Radio receiver characteristics, FM transmitter, Propagation of Radio Waves ,Antenna , Fundamentals of image transmission,TV transmitter,Transmission Lines etc.The course may provide the opportunity to work in any organization related to communication.
6	Practical: (PHY-5181)	**I**	Student would gain practical knowledge by performing various experiments.

7	Paper 6: Statistical Mechanics (PHY-4921)	II	The course structure includes different aspects of statistical Mechanics and Statistical models for phase transition. Study of this course will enable students a clear understanding of classical and Quantum Statistics.
8	Paper 7: Atomic and Molecular Spectra (PHY-4922)	II	The course structure includes atomic and molecular spectroscopy. As per the course structure, the students learn basics concepts of spectroscopic principles and rules. Students would learn technique in spectroscopy and know about their applications. The course is helpful for the students to explore R & D opportunities in various areas of science and technology such as biomedical, industrial and environmental fields.
9	Paper 8: Electrodynamics (PHY-4923)	II	The study of electrodynamics provides basic foundation for the student to understand advance courses of physics. The course includes Basic equations of Electromagnetism, Electrostatics; Magnetostatics; Maxwell's equation, Four Vector Formalism of Maxwell's Equations Four vector potential, electromagnetic field tensor and Quantization of electromagnetic energy
10	Paper 9: Digital Electronics and Computer Architecture (PHY-4924)	II	The course enables student to get knowledge about Digital Electronics and Computer Architecture. The course includes Fundamentals of Digital Circuit, Computer Organization and Architecture , Instruction formats & Microprocessor, Data Communication, Computer and Communications.The course helps student to work for the development of technology and also the for the industry and various Government organizations.
11	Practical: (PHY-5281)	II	The student will have adequate knowledge to perform the experiments of different fields of physics with clear understanding of the theory behind the experiment. Student will know about various electronic components and learn to design some basic electronic circuits and study their applications.
12	Paper 10: Advanced Quantum Mechanics (PHY-4931)	III	The course includes the study of scattering theory, identical particles, relativistic wave equations and quantization of wave fields. The course would describe the nature and behaviour of matter and energy at subatomic level. In particular, theory of scattering gives an understanding collision between a quantum mechanical particle and target. The study of relativistic quantum mechanics enables the students to understand the behaviour of objects moving with speeds comparable to that of light. The knowledge of this field forms the foundation for pursuing research in Quantum Field Theory and High Energy physics.
13	Paper 11: Nuclear Physics (PHY-4932)	III	In this course students would know about the general properties of nuclei, nuclear forces and detectors, radioactive decay and nuclear reactions.The course builds a foundation for the students to carry out research in the field of nuclear physics, high energy physics, nuclear astrophysics, nuclear reactions and applied nuclear physics.
14	Paper 12: Elementary	III	The course is important for the students to learn about the

	Particle Physics (PHY-4933)		most fundamental building blocks of matter and radiation, interaction among elementary particles and hence to understand their behaviour. The course provides a platform for the students seeking research opportunities in high energy physics.
15	Paper 13: Condensed Matter Physics (PHY-4934)	III	The students will be able to develop an understanding of the lattice, different types of crystal structures, symmetries. The student would gain insight about the interior of the substances using X-ray diffraction in crystals. This course also includes elastic waves, phonons, and lattice vibrational properties and also superconductivity. The course forms a theoretical basis of experimental material science and technology.
16	Paper 14: Plasma Physics (PHY-4935)	III	The course includes Magneto Hydrodynamics , Plasma Propagation and other topics related to plasma. Plasma physicists study plasmas, which are considered a distinct state of matter and occur naturally in stars and interplanetary space .The knowledge acquired by the student can be used in various field of Physics and thus career prospects are bright in the field of research.
17	Practical: (PHY-5381)	III	The student will have adequate knowledge to perform the experiments of different fields of physics with clear understanding of the theory behind the experiment. Student will know about various electronics experiments and some advanced experiments in Physics
18	Paper 15: Special Paper (Part-I) (a) Advanced Electronics-I (PHY-4941)	IV	This course helps the students to gain basic ideas of the construction and working of electronic devices and circuits . The course includes the study of IC technology, Operational amplifier as linear Analog systems and non-linear analog systems. The course is of much practical purpose for the students to learn basics of integrated circuit technology which has wide applications in computing, process control, signal processing, communication systems, digital instruments etc.
	(b) High Energy Physics-I (PHY-4942)		Students would be able understand the complex properties and behaviour of high energy particles at the microscopic level. This course would encourage students to peruse higher study and research in particle and high energy Physics.
	(c) Spectroscopy-I (PHY-4943)		In this course the students would study the various types of lasers, Laser spectroscopy and their applications in science and technology. Knowledge acquired by the course will be of much use for various industries and R&D sector .
	(d) Astrophysics-I (PHY-4944)		The course would be important to understand the spherical astronomy, distance measurement in astrophysics, and physics of solar system and extra solar planets. The course provides an opportunity to understand the optics of the different astronomical instruments such as: telescopes, CCD camera etc. It has wide spared in use of R& D sector.
	(e) Advanced Condensed Matter Physics-I (PHY-4945)		The course will introduce advance topics in crystal structure, symmetry, lattice dynamics and superconductivity

19	Paper 16: Special Paper (Part-II) (a) Advanced Electronics-II (PHY-4951)	IV	This course helps the students to gain basic ideas of the digital communication, optical communication, memory and optoelectronic devices. The course is of much practical purpose for the students to learn advanced concepts of digital communication systems.
	(b) High Energy Physics-II (PHY-4952)		The course would provide the knowledge of basic building blocks of matter and its complex properties.The students will also be able to know the complicated theory of Higgs mechanism which led to the detection of God particle in LHC experiment in the year 2012.It would open doors for the students who want to work in the field of HEP.
	(c) Spectroscopy-II (PHY-4953)		In this course the students would study the various types of lasers, Laser spectroscopy and their applications in science and technology. Knowledge acquired by the course will be of much use for various industries and R&D sector .
	(d) Astrophysics-II (PHY-4954)		The Course will provide the deeper understanding of the radiative transfer and the interaction of radiation with matter. It would be important to understand the physics of the death of stars. This study is crucial for the deeper knowledge of the neutron stars, white dwarfs and black holes. Their study provides the insight for the gravitational waves.
	(e) Advanced Condensed Matter Physics-II (PHY-4955)		the students will study Advance methods of crystallography and surface topography, Exotic Solids Structure and symmetries of liquids, Thin film and surface states and disordered systems.
20	Paper 17: Dissertation/Project work with Grade System	IV	The students will be given exposure to flavour of research.
21	Practical: (PHY-5481)	IV	The student will have adequate knowledge to perform the experiments of different fields of physics with clear understanding of the theory behind the experiment. Student will know about various electronics experiments and some advanced experiments in Physics

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