

## B.Sc. in Physics

### Study Plan

#### ■ University Compulsory Courses

16 C.H

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#### ■ University Elective Courses

9 C.H

Pages ( 64 &amp; 65 )

#### ■ Faculty Compulsory Courses

19 C.H

Line No.	Code	Course	
901010	MATH101	CALCULUS( 1)	3
901020	MATH102	CALCULUS (2)	3
901310	MATH131	ELEMENTS OF STATISTICS	3
921010	PHY101	GENERAL PHYSICS (1)	3
921020	PHY102	GENERAL PHYSICS (2)	3
921050	PHY105	GENERAL PHYSICS (LABORATORY)	1
1721150	CS115	C++ PROGRAMMING .	3

#### ■ Department Compulsory Courses

74 C.H

Line No.	Code	Course	
911010	CHEM101	GENERAL CHEMISTRY( 1)	3
911020	CHEM102	GENERAL CHEMISTRY (2)	3
911072	CHEM107B	GENERAL CHEMISTRY LAB	1
921060	PHY106	GENERAL PHYSICS (LABORATORY)(2)	1
922000	PHY200	INTRODUCTION TO MATHEMATICAL PHYSICS	3
922010	PHY201	MATHEMATICAL PHYSICS(1)	3
922110	PHY211	PROPERTIES OF MATTER AND HEAT	2
922210	PHY221	PROPERTIES OF MATTER AND HEAT (LAB)	1
922310	PHY231	ELECTRONICS (1)	3
922330	PHY233	ELECTRONICS (LAB) (1)	1
922510	PHY251	MODERN PHYSICS	3
922610	PHY261	THERMODYNAMICS	3
922810	PHY281	VIBRATIONS AND WAVES	3
922820	PHY282	OPTICS	3
922830	PHY283	OPTICS (LAB)	1
923010	PHY301	MATHEMATICAL PHYSICS (2)	3
923030	PHY303	COMPUTATIONAL PHYSICS	3
923110	PHY311	CLASSICAL MECHANICS (1)	3
923120	PHY312	CLASSICAL MECHANICS (2)	3
923310	PHY331	ELECTROMAGNETIC THEORY (1)	3
923322	PHY332B	ELECTROMAGNETIC THEORY (2)	3
923511	PHY351A	QUANTUM MECHANICS(1)	3
923520	PHY352	QUANTUM MECHANICS (2)	3
923530	PHY353	MODERN PHYSICS (LAB)	1
924401	PHY440A	ATOMIC PHYSICS	3
924491	PHY449A	NUCLEAR PHYSICS	3
924610	PHY461	STATISTICAL MECHANICS	3
924710	PHY471	SOLID STATE PHYSICS 1	3
931010	BIO101	GENERAL BIOLOGY (1)	3

#### ■ Department Elective Courses

12 C.H

Line No.	Code	Course	
902030	MATH203	ORDINARY DIFFERENTIAL EQUATIONS	3
922020	PHY202	SPACE PHYSICS	3
923330	PHY333	ELECTRONICS (2)	3
923410	PHY341	RADIATION PHYSICS	3
923460	PHY346	NUCLEAR TECHNIQUES (LAB)	1
923950	PHY395	RENEWABLE ENERGY	3
924010	PHY401	MATHEMATICAL PHYSICS(3)	3
924300	PHY430	PLASMA PHYSICS	3
924410	PHY441	INTRODUCTION TO RADIOBIOLOGY	3
924420	PHY442	ELEMENTARY PARTICLE PHYSICS	3
924451	PHY445A	NON-DESTRUCTIVE TESTING	3
924720	PHY472	SOLID STATE PHYSICS(2)	3
924730	PHY473	SEMICONDUCTORS PHYSICS	3
924740	PHY474	SOLAR CELLS	3
924810	PHY481	PHYSICAL OPTICS	3
924820	PHY482	INTRODUCTION TO THE LASER SCIENCES	3
924920	PHY492	SEMINAR	1
924931	PHY493B	SPECIAL TOPICS(B)	2
924932	PHY493A	SPECIAL TOPICS (A)	3
924933	PHY493C	SPECIAL TOPICS (C)	1

**TOTAL****130 C.H**

**\* For prerequisite & equivalent courses see the Courses' Description.**

## B.Sc. in Physics

### Courses' Description

#### **Phy101 General Physics 1**

Kinematics in one, two and three dimensions, dynamics, work and energy, conservation of energy, conservation of momentum, many bodies and collisions, rotational motion and equilibrium of rigid body, gravitation, periodic motion.

#### **Phy102 General Physics 2**

Charge and matter, electric field, Gauss's law, electric potential, capacitors and dielectrics, electromotive force and electric circuits, magnetic field, Ampere's law, Faraday's law of induction, self inductance, Maxwell's equations

#### **Phy103 General Physics**

Vectors algebra, kinematics of motion, dynamics, elasticity, fluid mechanics, electrostatics, electric flux, electric potential, capacitors, Ohm's law, circuits and Kirchoff's laws, magnetism, wave motion and sound waves, geometrical optics, modern physics, radioactivity, radiation doses.

#### **Phy105 General Physics Lab 1**

Experiments covering topics discussed in Phy101

#### **Phy106 General Physics Lab 2**

Experiments covering topics discussed in Phy102

#### **Phy107 General Physics Lab**

Experiments covering some topics discussed in Phy101 and Phy102

#### **Phy200 Introduction to mathematical physics**

Complex numbers, vector calculus, matrices and determinants, eigenvalues and eigenvectors.

#### **Phy201 Mathematical Physics 1**

Coordinate systems, limits and continuities, partial differentials, double and triple integrals, divergence and stocks theorems, first order differential equations.

#### **Phy202 Space Physics**

Kepler's laws, motion of the sun and other planets, calendars, electromagnetic spectrum and observatories

#### **Phy211 Properties of Matter and Heat**

Elasticity, flow of non-viscous fluids, flow of viscous fluids, heats and nature of matter, heat transfer, kinetic theory of gases, gravity

#### **Phy221 Properties of Matter and Heat Lab**

Experiments covering topics discussed in Phy211.

#### **Phy231 Electronics 1**

Alternating current circuits, conduction in solids, diodes, transistors, and FET, networks, amplifiers

#### **Phy233 Electronics Lab**

Experiments covering topics discussed in Phy231

#### **Phy251 Modern Physics**

Special relativity, concepts of waves and particles, introduction to quantum mechanics, atomic structure, quantum theory of the H-atom

#### **Phy261 Thermodynamics**

Temperature and the zero law, equation of state, heat, work and the first law of thermodynamics, entropy and the second law, thermodynamic potential, chemical potential, kinetic theory

#### **Phy281 Vibration and Waves**

Simple harmonic oscillations, forced and couples oscillations, motion of longitudinal waves, wave motion in two dimensions, Fourier method, non linear oscillations

#### **Phy282 Optics**

Reflection and refraction, mirrors, lenses, image formation, wave optics, nature of light, wave equation, interference, interferometers, diffraction, polarization, radiometry.

#### **Phy283 Optics Lab**

Experiments covering topics discussed in Phy282

#### **Phy301 Mathematical Physics 2**

Evaluation of integrals, integral transformation, special functions, partial differential equations

#### **Phy303 Computational Physics**

Using computer and programming languages to solve physical problems such as: differentiating and integrating, partial differential equation, linear algebra and matrices, modern physics, vibration and waves

#### **Phy311 Classical Mechanics 1**

Elements of Newtonian mechanics, motion in one, two, and three dimensions, motion of a system of particles, motion of rigid bodies, gravitation, moving coordinate systems.

#### **Phy312 Classical Mechanics 2**

Quick review of static's, Lagrange equations, Hamilton equations, tensor algebra, rotational dynamics of rigid bodies, theory of small oscillations

#### **Phy331 Electromagnetic Theory 1**

Quick review of vector analysis and electrostatics, solution of electrostatic problems in vacuum and in dielectric media, electrostatic energy, magnetic field of steady currents, magnetic properties of matter.

#### **Phy332 Electromagnetic Theory 2**

Electromagnetic induction, magnetic energy, Maxwell's equations, propagation of electromagnetic waves, polarization, reflection and refraction of EM waves, wave guides, radiation.

#### **Phy333 Electronics 2**

Power amplifiers, Oscillator principles, digital circuits, digital switching using integrated circuits, introduction to microprocessors

#### **Phy341 Radiation Physics**

Radiation sources (alpha, beta, gamma, neutrons, heavy ions), radiation interaction with matter, radiation detection and measurements using gaseous detectors, concept of exposure, absorbed dose and dose equivalent, dose limits, external and internal radiation control, radiation protection in factories, transport of radioactive materials.

#### **Phy351 Quantum Mechanics 1**

Limits of classical mechanics, wave packets and uncertainty principle, Schrödinger wave equation, potential well, eigenfunctions and eigenvalues, operators, angular momentum operators, the H-atom

**Phy352 Quantum Mechanics 2**

Review of ideal H-atom, interaction of electrons with magnetic field, operators and spin using matrices, addition of angular momentum and spin, time independent and time dependent perturbation theory, real hydrogen atom, helium atom, scattering theory

**Phy353 Modern Physics Lab**

This course includes basic concepts of modern physics in the following fields: many electron atoms, molecular structure, solid state, statistical mechanics, nuclear physics, elementary particles.

**Phy440 Atomic Physics**

Review of the atomic nature of matter. One electron-atom, fine structure, Hyperfine structure and interaction with external electric and magnetic fields. Many electron-atoms (the spectrum of the He-atom), X-ray spectra, Inner shells, Auger effect. Molecular structure and chemical bonding. Coulomb Scattering.

**Phy441 Introduction to Radiobiology**

Introduction to human biology, Radiobiology covering primary events in the cell. Deposition of energy, Molecular events, Biological expression of molecular damage. Radiation effects on various cells. Metabolism, Toxicity & therapy of radionuclides incorporated in man .

**Phy445 Non-Destructive Testing**

Introduction & scop. of NDT. Weldments & casting surface and internal defects, industrial Radiography, Ultrasonic examination of welds. Infrared inspection. Surface defects and their detection, Magnetic particles, Dyepenetrants & Eddy current flow detection, International Standards Codes of Practice.

**Phy449 Nuclear physics 3C.H**

Review, Nuclear Properties, nuclear models, nuclear radioactivity, Alpha decay, Beta, decay, Gamma decay, Nuclear reactions (fission and fusion), applications.

**Phy461 Statistical Mechanics**

Maxwell – Boltzmann statistics and its application Bose – Einstein statistics and its applications, Fermi – Dirac statistics and its application. Concepts of Temp, and Entropy, Thermodynamics of gases, and application of statistical thermodynamics, The Canonical ensemble, The Grand Canonical ensemble.

**Phy471 Solid State Physics**

Crystal structure and binding, Diffraction in crystals, Reciprocal lattice and lattice vibrations, Phonons and specific heat, Free-electron model.

**Phy481 Physical Optics**

Brief history of optics, Mathematics of wave motion, Electromagnetic theory of light, Fresnel Coefficients, Optics of thin films, polarization, Nature of polarized light, polarizers, Dichroism, Birefringence, retarders, Faraday rotation, Kerr effect, Optical activity, John matrices. Interference of two beams, interference of more than two beams, Mich. Interferometer, Fabry-Perot interferometer, Diffraction, theory of diffraction, Diffraction, theory of diffraction, Diffraction from slits and apertures, Diffraction Gratings.

**Phy482 Introduction to the Laser Sciences**

Principles of laser operation and laser cavity design, laser systems such as solid state, gas, and dye laser, Variety of laser applications such as communications systems, high resolution spectroscopy and laser interactions with solids.

**Phy492 Seminar**

Graduation project & Seminar.