

**COURSE OUTCOME OF
THREE-YEAR UNDERGRADUATE PHYSICS PROGRAM
UNDER THE UNIVERSITY OF CALCUTTA**

SYLLABUS: (1+1+1) 2010

After completion of three years undergraduate course in Physics (Hons.), students will be able to

CO 1 [Paper I]: learn about series and their convergence; vector algebra and vector calculus; matrices; ordinary and partial differential equations; Fourier series; solve simple mathematical problems involving these concepts; familiarize with oscillations, wave theory, Fermat's principle and geometrical optics using matrix formalism; acquire sound knowledge of network theorems, semiconductor diodes and BJT and FETs and also simple concepts of digital electronics.

CO 2 [Paper II-A]: learn elementary classical mechanics using Newton's laws of motion; system of particles, rotational motion including moment of inertia, Coriolis force and centrifugal force; solve simple mechanical problems using basic conservation laws of mechanics; in Unit 2, students learn about kinetic theory of gases, various equations of state for real gases, conduction problems, radiation; transport phenomena and determination of various transport coefficients;

CO 3 [Paper II-B]: carry out elementary experiments to find out different physical quantities like moment of inertia, rigidity modulus, refractive index; verify Stefan's law; verify truth table using integrated chips, convert a voltmeter into ammeter and vice versa, have first-hand idea about taking experimental readings, analyze data, find out the sources of errors; set up different experiments pertaining to different optical and thermal phenomena.

CO 4 [Paper III]: learn advanced concepts of electronics, circuit analysis of amplifiers, oscillators, OPAMP, introductory concepts of digital electronics like logic, boolean algebra, flipflops, registers, counters and communication principles, modulation; magnetic effect of steady current; electromagnetic induction; in Unit 2, students gather idea about electrostatics, multipole expansion, dielectric materials, solve boundary-value problems using method of images, analyze in detail different optical phenomena like interference, diffraction, polarization;

CO 5 [Paper IV-A]: familiarize with old quantum theory, new quantum mechanics, basic postulates of quantum mechanics, the laws of thermodynamics, entropy, different thermodynamic functions;

CO 6 [Paper IV-B]: measure wavelength using Newton's ring, handle the spectrometer and adjust it for experimental purpose; design and analyze different electronic circuits; fabricate electrical circuits using components available in the laboratory.

CO 7 [Paper V]: familiarize with concepts like central force problem, fluid mechanics, Lagrangian and Hamiltonian formulation of classical mechanics, special theory of relativity, simple relativistic effects like time dilation, length contraction, etc. In Unit 2, students learn to solve Schrodinger equation to solve for eigenvalues and eigenstates in Cartesian and spherical polar systems, atomic

and molecular spectroscopy, vector atom model and apply these concepts to solve simple physical problems from the microscopic world.

CO 8 [Paper VI]: understand nuclear reactions, interaction of nuclear radiation with matter; know about detectors for nuclear radiations, particle accelerators and gain basic concepts of particle physics with fundamental particles and quark structure. In Unit 2, acquire knowledge on theoretical description of crystal and electronic structure, lattice dynamics and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors) based on the classical and quantum physics principles.

CO 9 [Paper VII-A]: develop the phenomenological results of thermodynamics from a probabilistic examination of the underlying microscopic systems; develop intuition about different types of ensembles, study statistical systems in different ensembles; distinguish classical and quantum statistics; in Unit 2, students learn about the basic mathematical concepts related to electromagnetic vector fields; Maxwell equations; EM wave propagation in bounded and unbounded media; dispersion and scattering.

CO 10 [Paper VII-B]: use simple optical setups for determining the wavelength of light, verification of laws related to optics, fabricate circuit for analyzing BH loop, Anderson bridge, etc so that students have direct exposure to handling laboratory equipments;

CO 11 [Paper VIII-A, VIII-B]: design electronic circuits and analyze them using components available in the laboratory like flipflops, OPAMP, etc; further, write computer programs in FORTRAN or C to implement basic operations related to matrices, sorting, solution of differential equations, least square fitting, etc.