

KATHMANDU UNIVERSITY  
SCHOOL OF SCIENCE  
Department of ~~Natural Sciences~~ (Physics)

Course Title: **General Physics II**  
Level : B.Sc./B. E./~~B. Pharm./B. Tech.~~  
Year : I

Course Code: **PHYS 102**  
Cr. Hrs : 2 (32 Hrs.)  
Semester : II

**Course Objectives:** This course is especially prepared for first- year undergraduate students of all branches of science and engineering to help them develop physical intuition through a comprehensive understanding of fundamental concepts emphasizing physical concept rather than complicated mathematical treatments. The contents of the course include fundamentals of electricity, magnetism and modern physics. The topics are so chosen as to address the need of engineering and applied sciences.

### ELECTRICITY AND MAGNETISM

1. **Vector Analysis:** Scalar and vector product; Gradient of a scalar; Divergence and curl of a vector; Product rules and second derivatives; Line, surface and volume integrals of a vector; Fundamental theorem of gradients, divergences and curls; Spherical coordinate system. [3 Hrs.]
2. **Electrostatic field:** Electric charge; Coulomb's law; Electric field due to point and continuous charge distribution (line, ring and disc); Electric flux; Gauss's law and its differential form; Applications of Gauss's law for spherically symmetric charge distribution; Line integral and curl of an electric field; potential and potential difference; Relation between electric field and potential; Equation of electrostatic potentials (Poisson's equation, Laplace's equation); Energy of point and continuous charge distribution; Energy density in electric field. [6 Hrs.]
3. **Electrostatic field in matter:** The electric field of dipole; Force and torque on a dipole; Energy of dipole in electric field; Atomic polarizability; Polar and non-polar molecules; Polarization; Bound charges; Gauss's law in medium; Electric susceptibility; Electric field at the center of spherical cavity; Clausius-Mossotti relation. [4 Hrs.]
4. **Magnetostatics:** Magnetic field  $\mathbf{B}$ ; Lorentz's force, cyclotron and cycloid motion; Surface and volume current densities; Equation of continuity; Biot-Savart law and its application for line current, circular & square loop and solenoid; Magnetic flux; Divergence of  $\mathbf{B}$ ; Ampere's law and curl of  $\mathbf{B}$ ; Application of Ampere's law (line, solenoid and cylindrical current); Magnetic vector potential and its expressions. [4 Hrs.]
5. **Magnetostatic field in matter:** Magnetic dipole; Force and torque on magnetic dipole; Energy of magnetic dipole in magnetic field; Magnetization; Bound current; Ampere's law in magnetized materials; Magnetic susceptibility; Magnetic materials: diamagnetism, paramagnetism and ferromagnetism; Hysteresis curve and losses. [4 Hrs.]
6. **Electromagnetic induction:** Flux rule for motional emf in rectangular and arbitrary loops; Faraday's law of induction; Difference between static and induced electric field; Lenz's law; Mutual and Self inductions; Neumann formula; Energy stored in magnetic field. [3 Hrs.]
7. **Electromagnetic wave propagation:** Electrodynamics before Maxwell; Maxwell's correction; Maxwell's equations in vacuum; Maxwell's equations in material medium; Poynting's theorem and Poynting vector; Electromagnetic wave equation in vacuum. [3 Hrs.]

## MODERN PHYSICS

1. **Physics of atoms and molecules:** Molecular bonds, Energy states and spectra of molecules, Raman effect and its quantum treatment, Superconductivity: Meissner Effect, critical field and temperature. [3 Hrs.]
2. **Nuclear physics:** Nuclear binding energy; Radioactivity, half life, the decay processes; Nuclear reactions, Q-value and threshold energy in nuclear reaction; Nuclear fusion and fission. [2 Hrs.]

### Text Books

1. David J. Griffith, *Introduction to electrodynamics*. PHI Learning.
2. R. Resnick and H. Halliday, *Physics part II*. John Wiley and Sons.
3. Berkley Physics Series, *Electricity and magnetism*. Tata Mc-Graw Hill.
4. R. A. Serway and J. W. Jewett, *Physics for engineers and scientists*. Cenage Publications.