Physics I (PHY 105)
Tribhuvan University
Soch College of Information Technology
Bachelor of Science in Computer Science and Information Technology

Course Title: Physics I
Course no: PHY-105 ---------- Full Marks: 60+20+20
Credit hours: 3 ---------- Pass Marks: 24+8+8
Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)
Course Synopsis: The course deals with related topics in Mechanics and Electrodynamics. Mechanics: Non Relativistic Particle dynamics, conservation laws, harmonic Oscillator, dynamics of rigid body, strength of materials, hydrodynamics. Electrodynamics: Electrostatics, dielectrics, Electrostatic and magnetic energy, Maxwell's equation, propagation of electromagnetic wave. Laboratory works are designed to complement and supplement the theory course.
Goal: The course aims at introducing the concepts and methods of physics needed for application in various branch of modern science and technology.

Course Content:

Mechanics Unit 1. Newton's Law of Motion and Galilean Invariance ---------- 4 Hrs.
1.1 Newton's laws of motion
1.2 Reference frame, Galilean transformation, Galilean Invariance
1.3 Transformation equations
1.4 Non inertial frames of reference fictious forces
Centrifugal and coriolis forces
Unit 2. Non Relativistic Particle Dynamics ---------- 4 Hrs.
2.1 Equation of motion of uncharged and charged particles, Charged particles in constant and alternating electric field
2.2 Charged particles in a fields, magnetic field- cyclotron, magnetic focusing
2.3 Charge particles in combined electric and magnetic field
Unit 3. Conservation Laws---------- 7 Hrs.
3.1 Laws of conservation of momentum and energy.
3.2 Conservative forces, potential energy,
3.3 Potential energy in electric and gravitational fields.
3.4 Non conservative forces, General laws of conservation of energy.
3.5 Collision in three dimensions, lab and cm. frames of reference, final velocities after collision, scattering angle
3.6 Law of conservation of angular momentum - rotational invariance of potential energy
3.7 Example - motion of a planet, Kepler's laws
Unit 4. Harmonic Oscillator ---------- 6 Hrs.
4.1 Harmonic oscillator, energy, example: diatomic molecule.
4.2 An harmonic oscillator - pendulum with large oscillation

4.3 Damped oscillations, power factor, Q - factor
4.4 Driven oscillations, resonance, phase and half width
4.5 LCR and parallel resonance circuits.

Unit 5. Viscosity

---------- 2 Hrs.

5.1 Viscosity, Newton's law of viscous force, analogy between current flow and viscous flow
5.2 Motion of a body in a viscous medium.

Electrodynamics Unit 6. Electrostatics ---------- 7 Hrs.

6.1 Electric field and electric potential
6.2 Divergence of E and Gauss's law, applications
6.3 Solution of electrostatic problems, Poisson's and Lap lace's equations
6.4 Solution of Lap laces equations in spherical cylindrical coordinates and rectangular coordinates
6.5 Examples conducting sphere in a uniform E field, method of images, point charge and a conducting sphere, line charge and line images, systems of conductors.
6.6 Solution of Poisson's equation

Unit 7. Dielectrics ---------- 4 Hrs.

7.1 Electric field in a dielectric media
Polarization, field inside and outside a dielectric gauss's law in a dielectric medium-displacement vector, electric susceptibility and dielectric constant
Boundary conditions on field vectors, boundary value problems in a dielectric medium, dielectric sphere in a uniform el. field.
7.2 Molecular theory of dielectrics, induced dipoles

Unit 8. Electrostatic Energy ---------- 1 Hr.

8.1 Potential energy of a group of charges and charge distributions, energy density.
8.2 energy of a system of charged conductors

Unit 9. Magnetic Field Energy ---------- 1 Hr.

9.1 Vector potential, and magnetic field
9.2 Energy density in the magnetic field, magnetic energy of coupled circuits.

Unit 10. Slowly Varying Current ---------- 3 Hrs.

10.1 Transient and steady state behavior
10.2 Series and parallel connection of impedances
10.3 Power, power factor, Resonance.

Unit 11. Maxwell's Equation ---------- 6 Hrs.

11.1 Maxwell's equations - displacement current
11.2 Electromagnetic energy
11.3 Wave equations without and with source, boundary conditions

Laboratory Works:

To draw I-V characteristics of Ohmic and non Ohmic resisters and find voltage current ration.
To study the junction diode and LED characteristics.

To study the temperature dependence of resistance of a given semiconductors
To determine the moment of inertia of a fly wheel.
To determine the modulus of rigidity for the material of a rod by using the horizontal pattern of the twisting apparatus.
To determine the terminal velocity and find coefficient of viscosity by Stoke's method.
To determine the surface tension of work with a capillary tube.
To determine the impedance of a given LCR circuit.
To study characteristics of NPN transistor.
To determine dielectric constant by using Lissagous pattern.
To construct CE amplifier for the determination of the voltage gain of the amplifier.
To study the characteristic of a Zener a diode (Switches) and use it to regulate power supply.
To construct and study the working of NOT-AND-OR, NAND and NOR gates.
To construct and study the working of OR, NAN and NOR gates.

Text books:

D.S. Mathur, Mechanics, S. Chand and Company Ltd
John R. Ritz, Frederick J. Milford and Robert W. Christy, Foundations of Electromagnetic Theory, Narosa Publishing House

References:

David J Griffith, Introduction to Electrodynamics, 2nd Edition, Prentice Hall of India, 1994.

Prerequisite: Calculus based introductory physics

Note: Home work assignments: Several numerical problems to be given every week.