Rajarshi Janak University

Institute of Science, Technology and Engineering
Course of Study for B.Sc. CSIT
(First Semester/First Year)

Course Title: Physics
Course Code: CSPH 102
Nature of Course: Theory (3 hr.) + Lab(3 hr.)
Full Marks: Ext(40+20)+Int(40)
Credit hrs. : 3
Pass Marks: Ext(16+8)+Int(16)

Course Description:
This course introduces the foundational concepts of Physics tailored for undergraduate students in Information Technology. The curriculum bridges classical and modern physics principles with real-world IT applications. Topics include mechanics, electromagnetism, quantum mechanics, and semiconductor physics, emphasizing their role in the development and functioning of hardware, sensors, and communication technologies. Through theoretical learning, practical problem-solving, and laboratory experiments, students will develop a strong physical intuition and the ability to apply physics principles in designing innovative IT solutions.

Course Objectives:
At the end of this course the students should be able:

- Understand the fundamental laws of physics and their applications in Information Technology systems.
- Analyze mechanical systems and electromagnetic phenomena relevant to computing and telecommunications.
- Explore the principles of quantum mechanics and semiconductor physics as they apply to electronic devices and circuits.
- Conduct experiments to measure and evaluate physical parameters, linking theoretical concepts with practical applications.
- Develop problem-solving skills to address challenges at the intersection of physics and information technology.

Course Contents Unit-1

Review **[3 hrs.]**

Newton's laws of motion, Conservation Laws and non-Conservative forces, Kinetic energy, wok-energy principle, potential energy in the case of conservative force field, conservative force as a negative gradient of P.E. curl of conservative force, Law of conservation of Mechanical energy for conservative forces.

Unit-2

Particle Dynamics **[5 hrs.]**

Rotational dynamics, torque, moment of inertia, angular momentum, conservation of angular momentum, Rotational Kinetic Energy, Motion of charged Particles in constant electric field. Motion of charge particle in uniform magnetic field, cyclotron, Motion of charged particle in combined electric and magnetic field.

Unit-3

Harmonic Oscillator **[7 hrs.]**

Physical Pendulum: Differential equation for motion of physical pendulum, time period, interchangeability of point suspension and point oscillation, maximum and minimum time period. **Torsional pendulum:** Differential equation for motion of torsional pendulum, Time Period, Modulus of rigidity of suspension wire of torsional pendulum. **Damped Oscillation:** Differential equation, critical damping, overdamping and underdamping, power dissipation and quality factor (Q-factor), LCR series circuit as damped EM(electromagnetic) oscillation, Forced or driven harmonic oscillation, resonance, Driven EM Oscillation

Unit-4

Electrostatics **[7 hrs.]**

Electric field intensity, electric dipole and dipole moment, electric field intensity due to dipole (at an axial and equatorial line), electric quadrupole and quadrupole moment. Electric field intensity due to quadrupole (at an axial line), Electric potential due to a dipole, electric potential due to quadrupole (at an axial line), Electric flux, Gauss's Law, Applications of Gauss's aw: Spherical charge distribution (conducting, and non-conducting), Capacitor and Capacitance, Parallel plate capacitor, supercapacitor (introduction only), energy stored in electric field, energy density, Gauss law of dielectrics, Relation between electric field(E), displacement vector (D) and Polarization vector(P)

Unit-5

Magneto-statics **[5 hrs.]**

Lorentz force, force on charge involving in magnetic field, force on current carrying conductor placed in magnetic field, **Hall effect**, **Biot-Savart' law**, Application of Biot-Savat Law, Magnetic field due to straight conductor carrying current in it, magnetic field on the axis of a current carrying coil, magnetic dipole formed by the current carrying coil and magnetic moment of that coil, Magnetic force between current carrying conductors, Energy stored in magnetic field and energy density, Magnetic energy in coupled circuits.

Unit-6

Maxwell's Equation **[4 hrs.]**

Gauss's divergence theorem, stokes theorem, Induced magnetic field in capacitor (Ampere-Maxwell law in electromagnetism), displacement current, Equation of continuity, Maxwell' EM wave equations (Integral form and Differential form), EM wave equation without and with source, Relation between electric and magnetic fields in EM wave, poynting vector

Unit-7

Circuit Analysis **[5 hrs.]**

Kirchoff's current and voltage law, concept of current source and voltage source, application of Kirchoff's current and voltage law to simple circuits, Thevenin's and Norton's theorems and their applications. Basic diode circuit: Forward and reverse biasing, knee voltage, breakdown voltage

Unit-8

Bipolar Junction Transistor **[4 hrs.]**

CB, CC, CE configurations and their characteristics, relation between α and β, DC load line and Q point , CB, CE, and CC amplifiers (introduction only)

Unit-9

Introduction of Quantum Mechanics **[5 hrs]**

Introduction, inadequacy of classical mechanics, De-Broglie theory, Heisenberg's uncertainty principle, phase velocity, group velocity. Wave function, Interpretation of wave function, Schrodinger wave equations, normalization of wave function.

Laboratory Work:

1. To draw I-V characteristics of Ohmic and non Ohmic resistors and find voltage current ratio.
2. To determine the impedance of a given LCR circuit.
3. To study characteristics of NPN transistor in CE mode, CB mode, CC mode.
4. To construct and study the working of NOT-AND-OR, NAND, NOR gates.
5. To study the characteristic of simple junction diode and Zener diode
6. To determine the value of acceleration due to gravity by using Bar Pendulum.
7. To determine the moment of inertia of a flywheel.
8. To determine the angular acceleration of a flywheel.
9. To determine of modulus of rigidity of wire by torsional pendulum.
10. To determine the low resistance by Carey Foster bridge.
11. To determine the magnetic field using search coil.

Note:
Course instructor can conduct atleast 7 experiments according to the requirement.

Text Books/ References Books

1. D. S. Mathur, "**Mechanics", (revised by P.S. Hemne),** S. Chand and Company Ltd
2. David J. Griffith, "**Introduction to Electrodynamics:**", 3rd Edition, 2002,Prentice Hall of India, New Delhi
3. A. P. Malvino, "**Principles of Electronics**", Tata Mc-Graw Hill Publication, 7th Edition
4. John R. Ritz, Frederick J. Milford and Robert W. Christy, "**Foundations of Electromagnetic Theory**", Narosa Publishing House
5. Newtonian Mechanics, P. French, "**MIT Introductory Physics Series**", Viva Bools Pvt Ltd
6. D. Halliday, R. Resnick, J. R. Christman and J. Walker, "**Fundamentals of Physics**", wiley
7. B. L. Theraja, "**Basic Electronics**",S.Chand& Company Ltd, New Delhi
8. V. K. Meheta,"**Principles of Electronics**",S.Chand& company Ltd. 5th Edition
9. Arora C. L. "**B.Sc. Practical Physics"**, S. Chand and Company Ltd. (2010)
10. Squires G. L. "**Practical Physics",** Cambridge University Press (1999)
11. Powel J.L. and Craseman V. **"Quantum Mechanics"** Narosa Publishing House, New Delhi 1994
12. Mathews P.M. and Venkatesan K. " **A Textbook of Quantum Mechanics**" Tata Mc-Graw Hill Publication,1997