

CLUSTER UNIVERSITY SRINAGAR, KASHMIR

SYLLABUS– SEMESTER 2nd (CBCS) – INTEGRATED M.Sc. PHYSICS (CORE COURSE - THEORY)

Title: Electricity and Magnetism

Credits: 04

Course Code: PHY18-203C

Total: 100 Marks

Internal Assessment Test: 20 Marks

Semester End Examination: 80Marks

UNIT I

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and torque on a dipole.

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere. **(15 Lectures)**

UNIT II

Dielectric Properties of Matter: Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector **D**. Relations between **E**, **P** and **D**. Gauss' Law in dielectrics. **(15 Lectures)**

UNIT III

Magnetic Field: Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

Magnetic Properties of Matter: Magnetization vector (**M**). Magnetic Intensity (**H**). Magnetic Susceptibility and permeability. Relation between **B**, **H**, **M**. Ferromagnetism. B-H curve and hysteresis. **(15 Lectures)**

UNIT IV

Electromagnetic Induction: Review of (Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance). Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network

CLUSTER UNIVERSITY SRINAGAR, KASHMIR

SYLLABUS– SEMESTER 2nd (CBCS) – INTEGRATED M.Sc. PHYSICS (CORE COURSE - THEORY)

Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits. **(15 Lectures)**

Reference Books:

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
4. Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
5. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
6. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.