# PHYSICS: ELECTRICITY AND MAGNETISM

## ALLIED COURSE PAPER - II

**Vector Analysis**: Scalar and Vector product, gradient, divergence, Curl and their significance, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). (6 Lectures)

**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. (20 Lectures)

**Magnetism:**

Magnetostatics:Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials. (8 Lectures)

**Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. (6 Lectures)

**Maxwell`s equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transversality, polarization. (8 Lectures)

**Reference Books:**


- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J. H. Fewkes & John Yarwood. Vol. I, 1991, Oxford Univ.Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- David J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.


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## PHYSICS LAB: ELECTRICITY AND MAGNETISM LAB.

*(Students have to perform at least 5 experiments. Additional experiments may be included with the approval of the committee of courses)*

1) To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2) Ballistic Galvanometer:
   (vi) Measurement of charge and current sensitivity
   (vii) Measurement of CDR
   (viii) Determine a high resistance by Leakage Method
   (ix) To determine Self Inductance of a Coil by Rayleigh's Method.
3) To compare capacitances using De'Sauty's bridge.
4) Measurement of field strength B and its variation in a Solenoid (Determination of dB/dx).
5) To study the Characteristics of a Series RC Circuit.
6) To study the LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7) To determine a Low Resistance by Carey Foster's Bridge.
8) To verify the Thevenin and Norton theorem
9) To verify the Superposition, and Maximum Power Transfer Theorem

**Reference Books**


- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.


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