

- PHSGCOR02T - Electricity and Magnetism

Electricity and Magnetism	
60 Lectures	4 Credits
Vector Analysis	12 Lectures
Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).	
Electrostatics	18 Lectures
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. Electric potential due to an electric dipole. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate 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.	
Magnetism	10 Lectures
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.	
Electromagnetic Induction	6 Lectures
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.	
Linear Network	5 Lectures
Impedance of L, C, R and their combinations. Thevenin & Norton's Theorem. Maximum power transfer theorem and superposition theorem. Anderson's bridge.	
Maxwell's Equations and Electromagnetic Wave Propagation	9 Lectures
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, transverse nature of EM waves, polarization.

Reference Books

- ▶ Foundations of Electromagnetic Theory. J.R. Reitz, F.J. Milford and R.W. Christy, 2010, Pearson.
- ▶ Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- ▶ Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- ▶ Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
- ▶ Electromagnetism. I.S. Grant and W.R. Phillips, 2013, Wiley.
- ▶ Classical Electromagnetism. J. Franklin, 2008, Pearson Education.
- ▶ Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- ▶ Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw

• PHSGCOR02P – Electricity and Magnetism Lab

Electricity and Magnetism

60 class hours

2 Credits

General topic

Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances (e) Checking electrical fuses and (f) circuit continuity check. Demonstration on Carey Foster's bridge, potentiometer, resistance box, inductor coil, moving coil galvanometer (in dead beat and ballistic mode), etc.

List of Practicals

1. To determine an unknown Low Resistance using Carey Foster's Bridge.
2. To verify the Thevenin and Norton theorems.
3. To verify the Superposition and Maximum power transfer theorems.
4. To determine self-inductance of a coil by Anderson's bridge.
5. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
6. To study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.
7. To study the characteristics of a series RC Circuit.
8. To determine an unknown Low Resistance using Potentiometer.
9. To determine the resistance of a galvanometer using Thomson's method.
10. Measurement of field strength B and its variation in a solenoid (determine dB/dx)

Reference Books

- ▶ Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- ▶ A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- ▶ Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- ▶ Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, Cengage Learning.
- ▶ A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.