

# Syllabus PH1020

## 1 Electrostatics

- Force and electric field due to continuous charge distribution
- Field lines, Flux, Gauss's law
- Electric potential due to continuous charge distribution, equipotential line/ surface
- Poisson's equation and its solution, workdone in assembling a charge distribution
- Conductors and Capacitors
- Electric displacement vector, dielectric permittivity, and susceptibility, Gauss law in materials
- Electric dipole, force and torque on a dipole due to external static electric field, interaction energy between two dipoles.
- Multipole expansion

## 2 Magnetostatics

- Force law due to line current, surface current and volume current densities
- Biot-Savart-Law and Properties of magnetic field
- Magnetic flux, Divergence of B, magnetic Vector Potential A, Scalar potential
- Amperes law
- Multipole expansion, magnetic dipole moment, force and torque on a magnetic dipole due to external static magnetic field.
- Magnetization - Bound volume and surface current densities
- Auxillary field H - Magnetic susceptibility and permeability, general information about paramagnetism, diamagnetism and ferromagnetism
- Boundary conditions
- Force on a charged particle under electric and magnetic fields

### 3 Electromagnetics

- Electromotive force— Faraday's law of electromagnetic induction
- Self and mutual inductance
- Resonance and oscillations in electrical circuits
- Displacement current
- Maxwells equations in free space and in linear media
- Scalar and vector potentials, gauges
- Plane electromagnetic waves
- Electromagnetic energy density, Pointing vector
- Reflection and transmission of electromagnetic radiation at boundary, Wave guides

#### References

1. Griffiths D. J,- Introduction to Electrodynamics
2. E.M. Purcell and D. J. Morin - Electricity and Magnetism
3. Feynman R.P., Leighton R.B., and Sands M.,- The Feynman Lectures on Physics, Vol.2.