**PH 407: Electromagnetic Theory (3-1-0:4)**

**Electrostatics**

Coulomb’s law, electric field, divergence and curl, applications Gauss’s law , electric potential, work and energy, conductor, Laplace equation (1D, 2D and 3D), uniqueness theorem, separation of variables: Cartesian and spherical coordinates, multipole expansion. **[7L+2T]**

**Dielectric**

Field of an electric dipole, polarization, field of a polarized object, Gauss’s law in dielectrics, electric displacement, linear dielectrics, boundary value problems, energy in dielectrics. **[3L+1T]**

**Magnetostatics**

Introduction, Lorentz force, electric current, equation of continuity, Biot-Savart law and applications, curl and divergence, Ampere’s law and applications, magnetic potential, magnetization, field of a magnetized object, Ampere’s law in magnetized material, linear and nonlinear media. **[7L+3T]**

**Electrodynamics**

Electromotive force, Motional emf, Induced Electric Field, Faraday’sLaw,Inductance, Induced Magnetic Field. **[4L+1T]**

**Maxwell's Equations and Solution**

The equation of continuity for time-varying fields, inconsistency of Ampere's law, Maxwell's equation, conditions at a boundary surface. Uniform plane wave propagation, solution of a wave equation in the free-space with frequency domain and time domain, wave propagation in conducting medium and dielectric medium, penetration depth and polarisation, reflection by a perfect conductor, perfect dielectric, perfect insulator, surface impedance, transmission line analogy.**[9L+3T]**

**Power Flow and Poynting Vector**

Poynting's theorem, interpretation of $\vec{E}×\vec{H}$ instantaneous, average and complex Poynting vector, power loss in a plane conductor. **[6L+2T]**

**Textbooks and References**

1. D. J. Griffith, “Introduction to Electrodynamics”, 4th edition, Prentice Hall India, 2017.
2. J. D. Jackson, “Classical Electrodynamics”, 3rd edition, Wiley Eastern, 2007.
3. E. C. Jordan and K. G. Balman, “Electromagnetic Waves and Radiating Systems”, 2nd edition, Prentice Hall India, 2015.
4. P. Lorrain, D. R. Corson, and F. Lorrain, “Electromagnetic Fields and Waves”, 2nd edition, W.H. Freeman & Company, 1970.
5. M. A. W. Miah, “Fundamentals of Electromagnetics”, Tata McGraw Hill, 1982.
6. B. B. Laud, “Electromagnetics”, 3rd edition, New Delhi New Age International, 2011.
7. Matthew N.O. Sadiku and S.V. Kulkarni, “Principles of Electromagnetics”, 6th Edition, Oxford University Press, 2015.