

KAKATIYA UNIVERSITY-WARANGAL-TELANGANA

Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc (PHYSICS) II Year, SEMESTER-III **PAPER-III: ELECTROMAGNETIC THEORY** w.e.f academic year (2025-26) (CBCS)

Total: 56 Hrs (4hrs/week)

UNIT-I

Electrostatics: (8 hrs)

Electric Field, Concept of electric field lines and electric flux, Gauss's law (Integral and differential forms), application of Gauss's law-linear and plane, spherical charge distributions, Conservative nature of electric field 'E', Irrotational field, Electric potential: Concept of electric potential, relation between electric potential and electric field, potential energy of a system of charges, Energy density in an electric field, Calculation of potential from electric field for a spherical charge distribution.

Dielectrics: (6 hrs)

Dielectric properties of matter, Electric field in matter, polarization, polarization charge, electric susceptibility & dielectric constant, capacitors (Parallel, Spherical, Cylindrical plates) filled with dielectrics, Displacement vector D, Gauss Law in dielectrics, Relation of E, P & D.

UNIT-II

Magnetostatics: (14 hrs)

Concept of magnetic field 'B' and magnetic flux, Biot-Savart's law, B' due to a straight current carrying conductor, Force on a point charge in a magnetic field, properties of magnetic induction (B), curl and divergence of B, solenoidal field, Integral form of Ampere's law, Applications of Ampere's law- field due to current carrying straight conductor, circular coil and solenoidal, Energy stored in magnetic field., Magnetic energy in terms of current and inductance, Magnetic force between two current carrying conductors, Magnetic field intensity, Ballistic Galvanometer, Torque on a current loop in a uniform magnetic field, working principle of Ballistic Galvanometer, current and charge sensitivity, electromagnetic damping, critical damping resistance.

UNIT-III:

Electromagnetic Induction and Electromagnetic waves: (14 hrs)

Faraday's laws of induction (differential and integral form), Lenz's law, self and mutual Induction, Continuity equation, modification of Ampere's law, displacement current, Maxwell equations, Maxwell's equations in vacuum and dielectric medium, boundary conditions, Poynting's theorem, plane wave equation, transverse nature of EM waves, velocity of light in vacuum and in medium.

UNIT-IV:

Varying and alternating currents: (8 hrs)

Introduction, time constants in a LR and CR circuits (Growth and decay of currents), Growth and decay of currents in LCR circuits - Critical damping, Alternating current, relation between current and voltage in pure R,C and L-vector diagrams - Power in ac circuits, LCR series and parallel resonant circuit, frequency,Q-factor, AC & DC motors-single phase, three phase (basics only). RC low pass, High pass filters.



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Network Theorems (6 hrs)

Passive elements, power sources, Active elements, Network models: T and π Transformations, Superposition theorem, Thevenin's theorem, Norton's theorem. Reciprocity theorem and Maximum power transfer theorem (problems).

NOTE: Problems should be solved at the end of every chapter of all units.

Reference/Suggested Books:

- 1) **Fundamentals of electricity and magnetism** by Arthur F.Kip (McGraw-Hill,1968)
- 2) **Electricity and magnetism** by J.H.Fewkes & JohnYarwood.Vol.I (Oxford Univ.Press, 1991).
- 3) **Introduction to Electrodynamics**,3rd edition, by DavidJ.Griffiths,(Benjamin Cummings,1998).
- 4)**Electricity and magnetism** by Edward M.Purcell (McGraw-HillEducation,1986)
- 5)**Electricity and magnetism**.by DC Tayal (Himalaya Publishing House,1988)
- 6) **Electromagnetics** by Joseph A.Edminister 2nd ed., (NewDelhi:TataMcGrawHill, 2006).
- 7) **II year Physics** by Telugu Academy, Telangana



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