Semester	III	Course Title	Engineering Electromagnetics	Course Code	18 EC 36
Teaching Period	50 Hours	L – T – P – TL*	3 – 1 – 0 – 4	Credits	4
CIE*	40 Marks	SEE*	60 Marks	Total	100 Marks
CREDITS – 04					

Course objectives: This course will enable students to:

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb‘s law and Gauss law to different charge distributions and the applications of Laplace‘s and Poisson‘s Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart‘s, Amperes‘s Law and Stokes‘theorem for different current distributions.
- Infer the effects of magnetic forces.
- Know the physical interpretation of Maxwell‘equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

Module - 1

Coulomb’s Law, Electric Field Intensity and Flux density

Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density, Gauss’s Law and its applications. **L1, L2, L3**

Module -2

Divergence Theorem

Divergence, Maxwell’s First equation (Electrostatics), Vector Operator and divergence theorem.

Energy, Potential and Conductors

Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity of current, Boundary Conditions. **L1, L2, L3**

Module -3

Poisson’s and Laplace’s Equations

Derivation of Poisson‘s and Laplace’s Equations, Uniqueness theorem, Examples of the solution of Laplace‘s equation.

Steady Magnetic Field

Biot-Savart Law, Ampere’s circuital law, Curl, Stokes’ theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. **L1, L2,L3**

Module -4

Magnetic Forces

Force on a moving charge, differential current elements, Force between differential current elements.

Magnetic Materials

Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials **L1, L2, L3**

Module -5

Time-varying fields and Maxwell's equations

Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.

Uniform Plane Wave

Wave propagation in free space and good conductors (Skin Effect), Poynting's theorem and wave power. **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Apply the knowledge of physics and Vector calculus in the field of Electromagnetics and apply gauss's law to calculate E and D.
- Analyse the application of divergence theorem and calculate the energy of electric field in different charge distribution. Calculate the value of current and current density. Also calculate E, V and D using boundary conditions. Calculate the value of capacitance and energy under different conditions.
- Use Poisson's and Laplace equation's equation and uniqueness theorem to calculate potential V. Find the value H and use Biot-Savart's law and ampere's law for it. Calculate magnetic potential.
- Evaluate the magnetic forces under different conditions and calculate magnetic field parameters for different magnetic materials
- Analyse time varying electromagnetic field as governed by Maxwell's equations and evaluate power associated with EM waves using Poynting theorem.

Text Book:

- W. H. Hayt and J. A. Buck,—Engineering Electromagnetics, 7thEdition,Tata McGraw-Hill, 2009,ISBN-978-0-07-061223-5.

Reference Books:

- John Krauss and Daniel A Fleisch—Electromagnetics with applications, McGraw-Hill.
- N. Narayana Rao—Fundamentals of Electromagnetics for Engineering, Pearson.