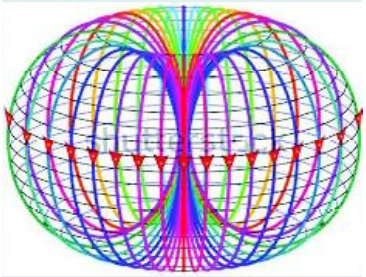
16EE205 ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES



Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
10	30	5	10	5	5

Course Description and Objectives:

This course offers the fundamental knowledge of electro magnetic fields involved in various electrical engineering applications. It introduces Cartesian, Cylindrical and Spherical coordinate systems for Electromagnetic Fields along with the concepts of electrostatics and dynamics for wave propagation in transmission lines and free space. The objective of course is to describe and analyze the facts behind the propagation of signals through transmission lines and free space.

Course Outcomes:

The student will be able to:

- understand various coordinate systems and their interrelation.
- apply vector calculus to static and dynamic electric-magnetic fields.
- analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse problems in electrical systems.
- analyze the propagation of wave forms in transmission lines and free space.

SKILLS:

- ü *Classify the material as linear, isotropic and homogeneous.*
- ü *Draw the magnetic flux patterns for various magnetic sources.*
- ü *Determine electromagnetic field intensities for various kinds of sources in different media.*
- ü *Determine dimensions of the transmission line for various initial conditions.*
- ü *Calculate the transmission line parameters such as characteristic impedance, propagation constant and absorbtion coefficient for mismatched load conditions.*

ACTIVITIES:

- *Draw the field lines due to point charge, line of charges and sheet of charges.*
- *Draw the field lines to illustrate refraction through dielectric.*
- *Draw the field lines to illustrate reflection through a metal plate.*
- *Identify the useful operating frequency range of the given metallic wire.*

UNIT - 1 **L- 10, T-3**

CO-ORDINATE SYSTEMS AND VECTOR CALCULUS : Introduction to coordinate systems, Cartesian, Cylindrical and spherical co-ordinate systems, Vector calculus - Differential length, area and volume, Introduction to line, Surface and volume integrals; Definition of Del operator, Gradient, Divergence and curl, Stokes theorem and Laplacian of a scalar.

UNIT - 2 **L- 09, T-3**

ELECTROSTATIC FIELDS : Coulomb's law in vector form, Introduction of electric flux, Electric flux density, Electric field intensity, Gauss's law, applications of Gauss's law, Electric field due to continuous distribution of charge, Electric dipole and energy density in electrostatic fields, Electric field in material space - Properties of materials, Convection and conduction currents, Conductors; Polarization in dielectrics, Dielectric constants, Continuity equation and relaxation time, Boundary conditions in electrostatics, Poisson's and Laplace's equations and capacitance.

UNIT - 3 **L- 09, T-3**

MAGNETO STATIC FIELDS : Magnetic flux and magnetic flux density, Biot-Savart's law, Ampere's circuit law, Application of Ampere's law, Scalar magnetic and vector magnetic potential, Nature of magnetic materials, Forces due to magnetic field, Magnetic torque and moment, Magnetic dipole, Magnetization in materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy.

UNIT - 4 **L- 08, T-3**

MAXWELL EQUATIONS AND WAVES PROPAGATION : Faraday's Law, Transformer and motional electromotive forces, Displacement current, Maxwell equations in differential and integral form, Electromagnetic wave propagation - Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, Plane wave in free space, Plane waves in good conductors; Power and the pointing vector, Reflection of a plane wave in a normal incidence.

UNIT - 5 **L- 09, T-3**

TRANSMISSION LINES : Introduction to transmission lines with parameters, Transmission line voltage and current equations, Input impedance, Characteristic impedance, Standing wave ratio and power, Some applications of transmission lines.

TEXT BOOKS:

1. William H. Hayt and John. A. Buck, "Engineering Electromagnetics", 7th edition, Mc. Graw- Hill Companies, 2005.
2. M.O.Sadiku, "Elements of Electromagnetics", 2nd edition, Oxford University Press, 1995.

REFERENCE BOOKS:

1. G.S.N. Raju, "Electromagnetic Field Theory and Transmission Lines", 2nd edition, Pearson Education, 2005.
2. John.D.Kraus, "Electromagnetics", 4th edition, McGraw Hill book Co., New York, 1991.
3. Joseph. A. Edminister, "Theory and Problems of Electromagnetics", 2nd edition, Schaum Series, Tata McGraw Hill, 1993.
4. S. Kamakshaiah, "Electromagnetic Fields", 1st edition, Right publishers, 2007.