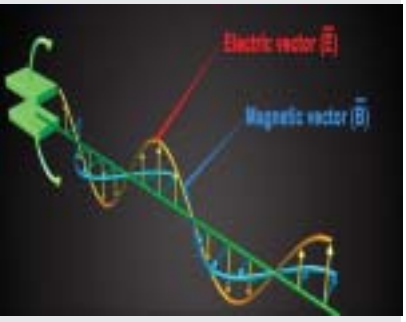

16EC304 ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course offers the fundamental knowledge of electro magnetic fields involving in various engineering applications. It gives the foundation in electromagnetism and its use in modern communication areas such as wired and wireless. The objective of the course is to enable the student familiarise with the propagation of low and high frequency signals through transmission lines and free space.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1: Discussthe various electromagnetic quantities in spatial distribution by various co-ordinate systems.

CO2: Understand the concepts of electric field intensity and electric flux density due to various charge distributions and applications of Gauss's law.

CO3: Analyze the magneto-static for charge distributions and boundary conditions.

CO4: Explain the Maxwell's Equations in integral and differential form.

CO5: Illustrate the concepts of electro-magnetic wave propagation, wave characteristics and poynting theorem.

CO6: Analyze the characteristics of transmission lines and solve the parameters using smith chart.

SKILLS:

- ✓ *Follow the path of electric field lines for a given regular geometric source.*
- ✓ *Classify the given material as linear, isotropic or homogeneous.*
- ✓ *Draw the magnetic flux lines for the given magnetic source.*
- ✓ *Calculate the emf and hence the inductance offered by coil.*
- ✓ *Use the wave equation to determine the field in various media.*
- ✓ *Consolidate the power conservation in electromagnetic waves.*
- ✓ *Identify the required dimensions of the transmission line for the given specifications.*
- ✓ *Calculate the matching transmission line parameters for the mismatched load.*

UNIT - 1 **L-9, T-3**

ELECTROSTATIC FIELDS: Review of coordinate systems and vector analysis, Coulomb's law, Electric field intensity, Electric flux density, Gauss's law, Applications of Gauss's law, Potential difference and potential, The dipole, Current and current density, Continuity of current, Conductor properties and boundary conditions, Nature of dielectric materials, Boundary conditions for perfect dielectric materials, Capacitance, Parallel plate capacitor, Poisson's and Laplace's equations.

UNIT - 2 **L-9, T-3**

MAGNETOSTATIC FIELDS: Biot Savart law, Ampere's Circuital law, Magnetic flux and magnetic flux density, Scalar and vector magnetic potentials, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Potential energy and forces on magnetic materials, Self inductance and mutual inductance.

UNIT - 3 **L-9, T-3**

MAXWELL'S EQUATIONS AND WAVE PROPAGATION: Faraday's law, Displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, Wave equations for free space and conducting medium, Uniform plane wave equation, Wave propagation - Free space, conducting medium, Good dielectrics, Good conductors; Skin depth, Wave polarization.

UNIT - 4 **L-9, T-3**

WAVE CHARACTERISTICS: Normal incidence of waves on perfect conductor and dielectric, Oblique incidence of waves on perfect conductor and dielectric, Brewster angle, Surface impedance, Poynting theorem and Poynting vector.

UNIT - 5 **L-9, T-3**

TRANSMISSION LINES: Introduction, Types of transmission lines, Concept of distributed elements, Equations of voltage and current, Phase and attenuation constants, Evaluation of arbitrary constants, Standing waves and impedance transformation, Loss less and low loss transmission lines, Impedance variation on lossless transmission lines, Important characteristics of a lossless line, Power transfer on transmission line, Smith chart.

TEXT BOOKS:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 3rd edition, Oxford Press, 2001.
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", 6th edition, TMH, 2001.

REFERENCE BOOKS:

1. G.S.N. Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 2005.
2. R.K Shevgaonkar, "Electromagnetic waves", TMH, 2006.
3. S.Salivahanan and S. Karthie, "Electromagnetic Field Theory", 1st edition, Oxford Press, 2016.

ACTIVITIES:

- *Draw the field lines due to point charge, line of charges and sheet of charges.*
- *Draw the field lines to illustrate reflection through a metal plate.*
- *Draw the field lines to illustrate refraction through dielectric.*
- *Identify the useful operating frequency range of the given metallic wire.*
- *Calculate the stub length and position to match the given antenna with 50/ 75 ohm line.*