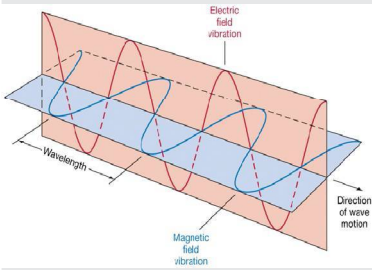
22EC305 ELECTROMAGNETIC WAVES AND TRANSMISSION LINES



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Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Physics

COURSE DESCRIPTION AND OBJECTIVES:

This course offers the fundamental knowledge of electromagnetic fields involving in various engineering applications. It gives the foundation in electromagnetic waves and Transmission lines and its use in modern communication areas such as wired and wireless. The objective of the course is to enable the student familiarize with the propagation, reflection, and transmission of plane waves in bounded and unbounded media and transmission lines.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

ELECTROSTATIC AND MAGNETOSTATIC FIELDS:

Review of coordinate systems and vector analysis.

Electrostatic Fields: Coulomb's law, Gauss's law, Applications of Gauss's law, Boundary conditions, Capacitance, Parallel Plate capacitor, Poisson's and Laplace's equations.

Magnetostatic Fields: Biot-Savart law, Ampere's Circuital law, Magnetic boundary conditions, Self-inductance and mutual inductance.

UNIT-2 **8L+0T+8P=16 Hours**

MAXWELL'S EQUATIONS AND TIME-VARYING FIELDS:

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.

PRACTICES:

- Generate Electromagnetic Wave using MATLAB software.
- Verification of Maxwell equation.
- Experiments on tracing of electric and magnetic flux lines for standard configuration
- Calculation of wave propagation in free space and conducting medium
- Calculation of uniform plane wave equation.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

WAVE PROPAGATION IN DIFFERENT MEDIA:

Free space, conducting medium, good dielectrics, good conductors; Skin depth, Wave polarization. Normal incidence of waves on perfect conductor and dielectric, Oblique incidence of waves on perfect conductor and dielectric, Poynting theorem and Poynting vector.

UNIT-2 **8L+0T+8P=16 Hours**

TRANSMISSION LINES:

Equations of voltage and current on TX line, Propagation constant and characteristic impedance, Reflection coefficient and VSWR, Impedance transformation on loss less and low loss transmission

SKILLS:

- ✓ *Analyze different coordinate systems the concept of gradient, divergence, and curl of a vector.*
- ✓ *Analyze application of Coulomb's Law and Gauss Law for electric fields produced by different charge configurations.*
- ✓ *Study the behaviour of the electric field across a boundary between a conductor and dielectric and between two different dielectrics.*
- ✓ *Study the time-varying fields and propagation of waves in different media.*
- ✓ *Analyze the transmission line impedance parameters.*

line, Power transfer on TX line, Smith Chart, Admittance Smith chart, Applications of transmission lines - impedance matching.

PRACTICES:

- Calibrate the Network Analyzer for Transmission line.
- Study the characteristics of a series RC and RL Circuit.
- Verification Scattering parameters using Smith chart.
- Microstrip Line design using HFSS.
- Analyze SW Pattern and SWR.
- Impedance Matching verification.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of static Electric & Magnetic fields to study Time-varying electro-magnetic field	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems of electromagnetic wave propagation.	Analyze	1	1, 2, 4,5, 9, 10,12
3	Analyze the phenomena of wave propagation in different media. Illustrate the concepts of electro-magnetic wave propagation and wave characteristics.	Analyze	2	1, 2,4,5, 9, 10,12
4	Analyze the characteristics of transmission lines and solve the parameters using smith chart.	Analyze	2	1, 2,3,4,5, 9, 10, 12

TEXT BOOKS:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th edition, Oxford Univ. Press, 2021.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian 8th edition, 2017.

REFERENCE BOOKS :

1. Jordan, E.C. and Balmain, K.G., 1968. Electromagnetic waves and radiating systems. Prentice-Hall.
2. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2017.
3. E.V.D. Glazier and H.R.L. Lamont, Transmission and Propagation, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi, 2014.
4. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
5. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.