II B.Tech – II Semester
(17EC402) ELECTRO MAGNETIC WAVES AND TRANSMISSION LINES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	3

Pre-Requisites:

Course Objectives:
- Fundamentals of steady electric and magnetic fields using various laws
- The concept of static and time varying Maxwell equations and power flow using pointing theorem
- Wave characteristics in different media for normal and oblique incidence
- Various concepts of transmission lines and impedance measurements

UNIT–I: Review of Co-ordinate Systems, Electrostatics
Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT–II: Magneto Statics
Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy. Illustrative Problems
Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric- Dielectric and Dielectric-Conductor Interfaces. Illustrative Problems.

UNIT–III: EM Wave Characteristics - I
Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types. Illustrative Problems.

UNIT–IV: EM Wave Characteristics – II
Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem – Applications, Power Loss in a Plane Conductor. Illustrative Problems.

UNIT–V: Transmission Lines - I
Types, Parameters, T&π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Loading - Types of Loading. Illustrative Problems.

UNIT–VI: Transmission Lines – II
Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements; Impedance Transformations λ/4, λ /2, λ/8 Lines, Quarter wave transformer, Smith Chart – Construction and Applications, Stub Matching-single &double, Illustrative Problems

Course Outcomes:

After successful completion of the course, the students can be able to:

S. No	Course Outcome	BTL
1.	Determine E and H using various laws and applications of electric & magnetic fields	L3
2.	Apply the Maxwell equations to analyze the time varying behavior of EM waves	L2
3.	Gain the knowledge in uniform plane wave concept and characteristics of uniform plane wave in various media	L1
4.	Calculate Brewster angle, critical angle and total internal reflection	L3
5.	Derive the expressions for input impedance of transmission lines	L4
6.	Calculate reflection coefficient, VSWR and stubs using smith chart	L3

Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	-	-	2	-	-	-	-	2	3	-
CO 2	3	3	2	3	-	-	2	-	-	-	-	2	3	-
CO 3	3	3	3	3	-	-	2	-	-	-	-	1	3	-
CO 4	3	3	3	2	-	-	-	-	-	-	-	-	2	-
CO 5	3	3	2	2	-	-	2	-	-	-	-	1	3	-
CO 6	3	3	3	3	-	-	2	-	-	-	-	1	3	-

Text Books:

1. Elements of Electromagnetics – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.

Reference Books:

1. Electromagnetic Fields and Wave Theory –GSN Raju, Pearson Education 2006
2. Engineering Electromagnetics :Nathan Ida, Springer(India)Pvt.Ltd., New Delhi, 2nd ed., 2005.
3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.
4. Electromagnetic Field Theory and Transmission Lines: G Sasi Bhushana Rao, Wiley India 2013
5. Transmission Lines and Networks–Umesh Sinha,Satya Prakashan (Tech. India Publications), New Delhi, 2001.
6. Electromagnetic waves and transmission lines – R S Rao, PHI, EEE edition.
7. Electromagnetic waves and transmission lines – Y.Mallikarjuna Reddy, University Press Publications 2015.