II B.Tech - I Semester
(20EC3004) ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre-Requisites: Mathematics

Course Objectives:
- Carryout a study on various analytical methods of calculating electric field intensities and electric potentials
- Describe various analytical methods of calculating magnetic field intensities and magnetic potentials
- Descriptive study on time varying electrical and magnetic field intensities and consolidating important laws as Maxwell's Equations
- Learn the fundamental concepts of the transmission lines in electromagnetic wave propagation
- Apply the knowledge of transmission lines to construct the Smith Chart and stub matching techniques.

UNIT–I: Electrostatics
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, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems

UNIT–II: Magneto Statics & Maxwell's Equations
Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic 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. Illustrative Problems

UNIT-III: EM Wave Characteristics
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, Poynting Vector and Poynting Theorem, Illustrative Problems. 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.

UNIT-IV: 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, Illustrative Problems.

UNIT–V: 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/8, λ/4 and λ /2 Lines –. Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.

Course Outcomes:

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

S.No	Course Outcome	BTL
1	Understand and apply Coulomb's law, Gauss's law equations for calculating electric field intensities and electric potentials in vacuum and materials due to various charge distributions.	L2
2	Understand and apply Biot-Savart's law, Ampere's circuital law for calculating magnetic field intensities and potentials (scalar & vector) in vacuum and materials due to steady electric currents	L2
3	Apply and analyse Faraday's law in generation of Electro Motive Force and modified Ampere's law to get finalized forms of Maxwell's equations.	L3
4	Know the fundamental concepts of the transmission lines in electromagnetic wave propagation	L2
5	Construct and design the Smith Chart and stub matching techniques with the knowledge of transmission lines	L5

Correlation of COs with POs& PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	1	-	-	1	-	-	-	-	-	2	-
CO2	3	2	-	1	-	-	1	-	-	-	-	-	2	-
CO3	2	2	1	3	-	-	2	-	-	-	-	-	2	-
CO4	1	1	1	2	-	-	1	-	-	-	-	-	3	-
CO5	1	1	2	2	-	-	1	-	-	-	-	-	3	-

Text Books:

1. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, Oxford University Press, Sixth (Asian) Edition, 2015.
2. Electromagnetic Waves and radiating systems – Edward C. Jordan and Keith G. Balmain, Prentice Hall of India, Second Edition, 2010.
3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, McGraw Hill, Eighth Edition. 2014.

Reference Books:

1. Electromagnetic Field Theory and Transmission Lines – G. S. N. Raju, Pearson Education, 2006.
2. Electromagnetic Field Theory and Transmission Lines – G Sasi Bhushana Rao, Wiley India, 2013.
3. Networks, Lines and Fields – John D. Ryder, Pearson Education, Second Edition, 2015.