EM WAVES AND TRANSMISSION LINES

Course Code: 15EC1107

L	T	P	C
3	1	0	4

Course Outcomes

At the end of the course the student will be able to

CO 1 Specify the "constitutive relationships" for fields and understand why they are required.

CO 2 Describe the characteristics of electromagnetic waves in medium.

CO 3 Acquire knowledge for Plane wave propagation at media interface

CO 4 Acquire knowledge for the measurement of basic transmission line parameters, such as the reflection coefficient, standing wave ratio, and impedance.

CO 5 Apply and analyze transmission line systems using Smith charts

UNIT I (10 Lectures)

ELECTROMAGNETIC FIELDS:

Introduction to Electromagnetic Fields, Maxwell's Equations in time domain and phasor domain-, Scalar and Vector Potentials, Continuity Equation, Relaxation time, Joules Law, Boundary Conditions at media interface, Ampere's Force Law, Poisson's and Laplace's Equations.

UNIT II (10 Lectures)

PLANE WAVE PROPAGATION:

Helmholtz Equations- Wave Equations for Conducting and Perfect Dielectric Media. Uniform Plane Waves, Uniform Plane Wave Propagation in Lossless and Lossy Media. Conductors & Dielectrics

– Characterization, Polarization, Surface Impedance, Poynting Vector and Poynting Theorem.

UNIT III (10 Lectures)

PLANE WAVES AT THE MEDIA INTERFACE:

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.

UNIT IV (10 Lectures)

TRANSMISSION LINES:

Transmission Line parameters and equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR, UHF Lines as Circuit Elements.

UNIT V (10 Lectures)

SMITH CHART

Smith Chart– Configuration, Applications, Impedance transformation-one-eighth, quarter, half wave transmission lines, Impedance matching- Single and Introduction to Double Stub Matching.

TEXT BOOKS:

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

REFERENCES:

1. Nathan Ida, "*Engineering Electromagnetics*" Springer (India) Pvt. Ltd., New Delhi, 2nd ed., 2005.
2. John D. Ryder, *"Networks, Lines and Fields"* PHI, 2nd ed., 1999.
3. William H. Hayt Jr. and John A. Buck, *"Engineering Electromagnetics"* TMH, 7th ed., 2006.

4. G.S.N. Raju, *"Electromagnetic Field Theory and Transmission Lines"* Pearson Ed., 2005.

5. G. Sasi Bhushana Rao, *"Electromagnetic Field Theory and Transmission Lines"*, Wiley India Pvt. Ltd, 2012.

6. Bhag Singh Guru, H R. Hiziroglu , *"Electromagnetic Field Theory Fundamentals"*, Cambridge university press, 2004