II Year-II Semester		L	T	P	C
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EM WAVES AND TRANSMISSION LINES (RT22044)

Prerequisite Course:

Vector calculus and co-ordinate geometry

Course Description and 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 andVarious concepts of transmission lines and impedance measurements

CourseOutcomes:

Uponcompletionofthecourse,thestudentwillbeabletoachievethefollowingoutcomes.

Cos	CourseOutcomes	POs
1	Determine E and H using various laws and applications of electric & magnetic	3
2	Apply the Maxwell equations to analyze the time varying behavior of EM waves	3
3	Gain the knowledge in uniform plane wave concept and characteristics of	2
4	Calculate Brewster angle, critical angle and total internal reflection	2
5	Derive the expressions for input impedance of transmission lines	3
6	Calculate reflection coefficient, VSWR etc. using smith chart	3

Syllabus:

UNIT I:
Objective: Understanding Fundamentals of steady electric and magnetic fields using various laws

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, RelaxationTime, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.[1,5]

UNIT II:
Objective : Understanding the concept of static and time varying Maxwell equations and power flow using pointing theorem

Magneto Statics :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 MagneticFields, Ampere's Force Law, Inductances and Magnetic Energy. Illustrative Problems. [1,5]
Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer emf, Inconsistency of Ampere'sLaw 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.[1,2]

UNIT III:

Objective: Gain the knowledge in uniform plane wave concept and characteristics of uniform plane

EM Wave Characteristics - I: Wave Equations for Conducting and Perfect Dielectric Media, UniformPlane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossydielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types.Illustrative Problems. [1,2,3]

UNIT IV:

Objective : Understanding Calculate Brewster angle, critical angle and total internal reflection

EM Wave Characteristics – II: Reflection and Refraction of Plane Waves – Normal and ObliqueIncidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total InternalReflection, Surface Impedance. Poynting Vector and Poynting Theorem – Applications, Power Loss in a PlaneConductor. Illustrative Problems. [2,3,4]

UNIT V:

Objective : Understanding expressions for input impedance of transmission lines

Transmission Lines - I : Types, Parameters, T&π Equivalent Circuits, Transmission Line Equations,Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and GroupVelocities, Infinite Line, Lossless lines, distortion less lines, Loading - Types of Loading. Illustrative Problems.[1,7]

UNIT VI:

Objective: Understanding reflection coefficient, VSWR etc. using smith chart

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; ImpedanceTransformations λ/4, λ /2, λ/8 Lines –. Smith Chart – Construction and Applications, Quarter wave transformer,Stub Matching-single & double, Illustrative Problems. [1,7]

TEXT BOOKS:

1. Elements of Electromagnetic – 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 SasiBhushanaRao,Wiley India 2013
5. Transmission Lines and Networks–UmeshSinha,SatyaPrakashan (Tech. India Publications), New Delhi, 2001.
6. Electromagnetic waves and transmission lines – R S Rao, PHI, EEE edition