JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA

II B.Tech II Sem (E.C.E) **L – T – P – C** **3 – 0 – 0 – 3**

EM WAVES AND TRANSMISSION LINES

COURSE OBJECTIVES:

1. To understand and analyze different laws and theorems of electrostatic fields.
2. To study and analyze different laws and theorems of magnetostatic fields.
3. To analyze Maxwell's equations in different forms.
4. To learn the concepts of wave theory and its propagation through various mediums.
5. To get an exposure to the properties of transmission lines.

UNIT I

Electrostatics: Review of Vector algebra, Co-ordinate systems & transformation, Vector calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

Learning Outcomes:

At the end of the unit, the student will be able to

- Understand vector algebra, vector calculus andconcepts related to electrostatic Fields.
- Analyze and solve the problems related to electrostatic fields.

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, Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems.

Learning Outcomes:

At the end of the unit, the student will be able to

- Comprehend the laws, concepts and proofs related to Magnetostatic Fields.
- Analyze and solve the problems related to magnetic fields.

UNIT III

Maxwell's Equations : Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

Learning Outcomes:

At the end of the unit, the student will be able to

- Understand the significance and utility of Maxwell's Equations.
- Appreciate the importance of boundary conditions in electromagnetics.

UNIT-IV

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves ,All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Wave Propagation in Good Conductors and Good Dielectrics, Skin depth, physical significance of Skin Depth,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, Illustrative Problems.

Learning Outcomes:

At the end of the unit, the student will be able to

- Analyze the characteristics of Uniform Plane Waves (UPW)
- Understand the propagation of electromagnetic waves in different media.

UNIT-V

Transmission Lines: Types, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications of transmission lines of various lengths, Basics of waveguides and resonators. Illustrative Problems.

Learning Outcomes:

At the end of the unit, the student will be able to

- Determine the basic transmission line equations and their characteristics,
- Understand the smith chart and its applications.

TEXT BOOKS:

1. Elements of Electromagnetics, Matthew N.O. Sadiku, 4th Edition, Oxford University Press, 2008.
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, 2nd Edition, PHI, 2000.

REFERENCES:

1. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, 7th Edition, Tata McGraw Hill, 2006.
2. Electromagnetics, John D. Krauss, 3rd Edition, McGraw Hill, 1988.
3. Networks, Lines, and Fields, John D. Ryder,2nd Edition, PHI publications, 2012.
4. Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju, 2nd Edition, Pearson Education, 2013.

COURSE OUTCOMES:

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

1. Analyze and apply the laws & theorems of electrostatic fields to solve the problems.
2. Gain proficiency in the analysis and application of magnetostatic laws and theorems.
3. Analyze Maxwell's equations in different forms.
4. Learn the concepts of wave theory and its propagation through various mediums.
5. Understand the properties of transmission lines and their applications.