JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year-II Semester		L	T	P	C
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ELECTROMAGNETIC WAVES and TRANSMISSION LINES					

Course objectives:

The main objectives of this course are to understand

- Fundamentals of steady electric and magnetic fields using variouslaws
- Apply the concept of static and time varying Maxwell equations and power flow using pointingtheorem
- Wave characteristics in different media for normal and obliqueincidence
- Implement various concepts of transmission lines and impedancemeasurements

SYLLABUS:

Prerequisites: Understanding of Cartesian co-ordinates, spherical & cylindrical systems

UNIT I:

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, Illustrative Problems.

UNIT II:

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

UNIT III:

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 IV:

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. IllustrativeProblems**.**

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.Illustrative Problems.

UNIT V:

EM Wave Characteristics : Wave Equations for Conducting and Perfect Dielectric Media,

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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.

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.Illustrative Problems.

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 Field Theory and Transmission Lines –GSN Raju, Pearson Education2006
2. Engineering Electromagnetic – William H. Hayt Jr. and John A. Buck, TMH, 7th ed.,2006.
3. Electromagnetic Field Theory and Transmission Lines: G SasiBhushana Rao,WileyIndia 2013.
4. Networks,LinesandFieldsJohn D. Ryder,Second Edition, PearsonEducation,2015.

Course Outcomes:
At the end of this course the student can able to
- Determine E and H using various laws and applications of electric & magneticfields
- Apply the Maxwell equations to analyze the time varying behavior of EMwaves
- Gain the knowledge in uniform plane wave concept and characteristics of uniformplane wave invariousmedia
- Calculate Brewster angle, critical angle and total internalreflection
- Derive andCalculate the expressions for input impedance of transmission lines,reflection coefficient, VSWR etc. using smithchart