G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE

(For Women)

(AUTONOMOUS)

Shaikpet, HYDERABAD - 500 104

II Year B.Tech. EEE I-Semester

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ELECTROMAGNETIC FIELDS

Prerequisites: Physics

Course Objectives:

1. To understand and apply the concepts of electric fields and magnetic fields.
2. To gain understanding of Maxwell's equations for both static and time varying fields.
3. To introduce the concepts of plane wave motion and Electromagnetic Interference.

Unit 1: (~12 Lecture Hours)

Static Electric Fields

Review of Vector Algebra, co-ordinate Systems, Unit Vectors, Scalar & Vector Products, Differential Lengths, Differential Surfaces & Differential Volumes. Coulomb's Law, Electric Field Intensity (EFI), EFI due to Point, Line, Surface &Volume Charges-Gauss Law & its Applications – Divergence- Maxwell's First Equation - Divergence Theorem –Electric Potential-Maxwell's Second Equation–Potential Gradient, Electric Dipole, Electrostatic Energy & Energy Density.

Unit 2: (~8 Lecture Hours)

Conductors, Dielectrics & Capacitance

Behavior of Conductors in an Electric Field-Current – Current Density-Continuity Equation-Point Form of Ohm's Law, Dielectrics – Polarization – Dielectric Constant-Boundary Conditions, Capacitance-Capacitance of a Two Wire Line, Poisson's & Laplace's Equations – Solution & Applications of Laplace's Equation.

Unit 3: (~9 Lecture Hours)

Static Magnetic Fields

Biot-Savart's Law-Magnetic Field Intensity (MFI) – MFI due to Straight, Circular & Solenoidal Current Carrying conductors, Ampere's Circuital Law & its Applications-Curl –Maxwell's Third Equation-Stoke'sTheorem, Magnetic flux- Magnetic Flux Density-Maxwell's Fourth Equation, Scalar and Vector Magnetic Potentials & their Properties.

Unit 4: (~8 Lecture Hours)

Forces in Magnetic Fields & Inductance

Force on a Moving Charge-Lorentz's Force Equation-Force on a Differential Current Element-Force between Two Straight Long Parallel Current Carrying

Conductors, Nature of Magnetic Materials-Magnetic Dipole-Magnetization and Relative Permeability,Magnetic Circuits-Self & Mutual Inductances, Magnetic Energy Stored and Energy Density.

Unit 5: (~9 Lecture Hours)
Time Varying Fields & Electro Magnetic Interference

Faraday's Laws of Electromagnetic Induction –Statically & Dynamically Induced EMF, Displacement Current, Modification of Maxwell's Equations for Time Varying Fields.
Uniform Plane Waves-Maxwell's Equations in Phasor form (Qualitative Treatment Only),Poynting Theorem &Poynting Vector.
Introduction to Electro Magnetic Interference and Electro Magnetic Compatibility (EMI & EMC) – Sources and Characteristics of EMI (Elementary Treatment Only).

Text Books:

1) William H Hayt &John A Buck,Engineering Electromagnetics,McGrawHill
2) Sadiku, "Electromagnetic Fields", Oxford Publications

Reference Books:

1) D J Griffiths, Introduction to Electro Dynamics, Prentice Hall of India Pvt. Ltd.
2) J D Kruas, Electromagnetics, McGraw Hill
3) AshutoshPramanik, Electromagnetism – Problems with solutions, Prentice Hall of India Pvt. Ltd
4) William H Hayt & John A Buck, Electromagnetics – Problems and Solutions, McGraw Hill.

Course Outcomes:

1. Apply the principles of Vector Algebra to understand the basic laws of electric and magnetic fields.
2. Distinguish between the properties of conductors & Dielectrics under the influence of both electric and magnetic fields.
3. Formulate and Solve typical problems w.r.t. electrostatics and magneto statics in different media.
4. Analyze/interpret various field equations in both point form and integral form.
5. Analyze the problems related to both static and time varying fields by using Maxwell's Equations.
6. Extend the concepts of field theory to realize plane wave motion and also acquire the concepts of Electromagnetic Interference.

1) N. Malleshulu
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16) R. Balasubramanian