ELECTROMAGNETIC ENGINEERING

(Core Subject)

Course Code:	10B11EC513	**Semester:**	5th Semester, B. Tech (ECE)
Credits:	4	**Contact Hours:**	L-3, T-1, P-1

Course Objectives

1. To provide the basic skills required to understand, develop, and design various engineering applications involving electromagnetic fields.
2. To lay the foundations of electromagnetism and its practice in modern communications such as wireless, guided wave principles such as fiber optics and electronic electromagnetic structures.

Course Outcomes

After study through lectures and assignments, students will be able to:

1. Apply vector calculus to static electric-magnetic fields in different engineering situations.
2. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
3. Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
4. Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.

Course Contents

Unit	**Topics**	**References (chapter number, page no. etc)**	**Lectures**
1.	Vector Calculus and Co-ordinate systems: Scalar and Vector product, Line, surface and volume integral, Gradient, Curl and Divergence, Rectangular, Cylindrical and Spherical co-ordinate systems.	Dr. Sunil Bhooshan	5
2.	Electrostatics: Coulomb's law, Electric field, electric field due to point charges, dipole, infinite line charge and infinite sheet charge, Electric displacement and electric flux density, electric potential, equipotential surfaces, potential energy, current density, continuity equation, Capacitance, boundary conditions, Laplace and Poisson's equations.	William H.Hayat	10
3	Magnetostatics: Bio-Savart law, Ampere's law, Magnetic field, Magnetic scalar potential ,Magnetic vector potential, Magnetic flux density, Lorentz force, Electron moving in a steady magnetic field, A straight wire carrying a	William H.Hayat	7

	current in a magnetic field, Force between two current elements, Inductance and mutual inductance.		
4	Time dependent fields and Electromagnetic waves: Time dependent Maxwell's equations (Differential and Integral form), Time and Frequency domain wave equations, wave polarization (Circular and Elliptical), Boundary conditions, Reflection and Refraction of waves, Pointing vector and Poynting theorem.	William H.Hayat	11
5	Transmission Lines and Wave guides: Time domain and Frequency Domain transmission line equations, Solution of transmission line equation, Standing wave ratio, $\lambda/8$, $\lambda/4$, $\lambda/2$ transmission line, transmission line charts, Parallel Plate waveguide, Rectangular and Circular waveguides.	David M. Pozar	9
		Total Number of Lectures	**42**

Evaluation Scheme

1. Test 1 : 15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
   - 10 Marks : Class performance, Tutorials & Assignments
   - 10 Marks : Quizzes
   - 5 marks : Attendance

Text Books

1. Prof. Dr. Sunil Bhooshan, 'Fundamentals of Engineering Electromagnetics', Oxford University press, 2012.
2. William H.Hayat and J. A.Buck, 'Engineering Electromagnetics',7thed, Tata McGraw Hill.
3. David M. Pozar, 'Microwave Engineering', 4thed, John Wiley & Sons.
4. C.A.Balanis, 'Antenna Theory',3rded, John Wiley & Sons.

Reference Books

1. Jordan Balmin, 'Electromagnetic waves and Radiating Systems'.
   M. Sadiku, 'Elements of Electromagnetics'.