BEEE202L	Electromagnetic Theory	L	T	P	C
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Pre-requisite	**NIL**	**Syllabus version**			
		1.0			

Course Objectives:

1. Familiarize with various coordinate systems and electromagnetic vector fields.
2. Impart knowledge on the concepts of electrostatic, magnetostatic and electrodynamic fields.
3. Disseminate concepts related to electromagnetic waves, waveguides and applications of electromagnetic fields.

Course Outcomes:

On the completion of this course the student will be able to:

1. Identify and implement an appropriate coordinate system for the given electromagnetic field problem.
2. Apply concepts of electrostatics for applications related to electric fields.
3. Apply principles of magnetostatics for computing parameters related to magnetic fields.
4. Understand the concepts of electrodynamic fields and apply Maxwell's equations to electromagnetic wave propagation.
5. Comprehend and analyze the major applications of electromagnetic waves.

Module:1	**Vector Analysis**	**5 hours**

Sources and effects of electromagnetic fields; Review of scalar and vector fields, different coordinate systems: Cartesian, cylindrical and spherical; Coordinate transformation: Differential elements in different coordinate systems, Del-operator, divergence, curl and gradient; Divergence theorem; Stoke's theorem

Module:2	**Electrostatic Fields**	**7 hours**

Coulomb's law, electric field intensity, electric flux, Gauss's law, potential due to point, line and surface charge distributions; Continuity equation and relaxation time; Boundary conditions, Laplace, Poisson's equations and solutions; Analytical methods: Variables separable method; Electrostatic energy, capacitance calculations

Module:3	**Magnetostatic Fields**	**7 hours**

Magnetic fields, magnetic flux, Biot-Savart's law, Ampere's law; Magnetic torque and moment; Forces due to magnetic fields; Vector potential; Magnetic boundary conditions; Magnetic energy, inductance calculations

Module:4	**Maxwell's Equations and Time Varying Fields**	**10 hours**

Faraday's law, Lenz's law; Maxwell's equations, displacement current, Maxwell's equations in final forms, time varying fields; Relation between field theory and circuit theory; Applications of electromagnetic conversion; Properties of conductor and dielectrics; Wave equations for free space, wave equations for conductors, skin effect, complex permittivity; Power and Poynting vector and theorem

Module:5	**Uniform Plane Waves**	**10 hours**

Uniform plane wave propagation: Wave equations, transverse nature of uniform plane waves, perpendicular relation between E and H; Electromagnetic waves in charge free region, current free dielectric; Reflection by ideal conductor: Normal incidence, reflection and transmission with normal incidence at another dielectric, plane wave in lossy dielectric;

Wave impedance and propagation constant, depth of penetration, surface impedance and surface resistance		
Module:6	**Applications of Electromagnetics**	**4 hours**
Application of electromagnetic propagation through transmission lines and rectangular waveguides; Wireless power transfer; Electromagnetic interference, electromagnetic compatibility		
Module:7	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Matthew N. O. Sadiku and S. V. Kulkarni, Principles of Electromagnetics, 2015, 6th Edition, Oxford University Press, New York
Reference Books	
1.	W H Hayt Jr, J A Buck &M Jaleel Akhtar, Engineering Electromagnetics, 2020, 9th Edition, McGraw Hill Education
2.	Mahmood Nahvi & Joseph A. Edminister, Schaum's Outline of Electromagnetics, 2018, 5thEdition, McGraw Hill Education
3.	Karl E. Lonngren, Sava Savov, Randy J. Jost, Fundamental of Electromagnetic with MATLAB, 2007, 2ndEdition, Scitech Publishing Inc.
4.	J. Edminister and Vishnu Priye, Electromagnetics, 2017, 2ndEdition, Schaum's Series
Mode of Evaluation: CAT, Digital Assignments, Quiz and FAT	

Recommended by Board of Studies	30-10-2021		
Approved by Academic Council	No. 64	Date	16-12-2021