Course Code	Course Title	L	T	P	C
1151EC108	ELECTROMAGNETIC FIELDS	2	2	0	3

a) Course Category

Program Core

b) Preamble

To familiarize the students with the basic concepts and calculations pertaining to electric, magnetic and time is varying electromagnetic fields so that an in depth understanding of antennas, electronic devices and Waveguides are possible

c) Prerequisite

Nil

d) Related Courses

Waveguides & Antennas

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Solve electrostatic field problems using Coulomb's law and Gauss law with the associated boundary value-conditions.	K3
CO2	Solve magneto static field problems using Biot-Savart law and Ampere's circuit law with the associated boundary conditions.	K3
CO3	Explain time-varying electromagnetic field governed by Maxwell's equations.	K3
CO4	Interpret electromagnetic waves and its propagation in different medium.	K3
CO5	Interpret uniform plane wave and its propagation in different medium.	K3

f)	Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	-	-	-	-	L	-	-	-	L	L	-
CO2	H	M	L	-	-	-	-	L	-	-	-	L	L	-
CO3	H	M	L	-	-	-	-	L	-	-	-	L	-	-
CO4	H	M	M	L	L	L	L	L	L	L	-	L	-	-
CO5	H	M	M	L	L	L	L	L	L	L	-	L	-	-

g) Course Content

UNIT I STATIC ELECTRIC FIELDS 12

Coordinate Systems and Transformation: Cartesian co-ordinates-Cylindrical Co-ordinates-Spherical coordinates. Vector Calculus: Differential length - area and volume-Line, surface and volume integrals- Del operator-Gradient of a scalar-Divergence of a vector and Divergence theorem-Curl of a vector and Stroke's theorem. Electrostatic Fields: Coulombs law-Electric field intensity-Principle of superposition- field intensity due to point charges and continuous distribution of charges-Energy and Energy Density in Electrostatic Fields. Electrostatic Fields in Material Space: Dielectric strength-Polarization in Dielectrics Permittivity-Boundary Condition. Electrostatic boundary - Value Problems: Capacitance- Poisson and Laplace equation and their application

UNIT II STATIC MAGNETIC FIELDS 12

Magneto static Fields: Magnetic field intensity and magnetic flux density-Ampere's Circuital law-Biotsavart law-The scalar and vector magnetic potentials. Magnetic Forces, Materials and Devices: Magnetic dipole-Magnetic - Boundary Conditions – Inductance - Energy in an Inductor and Energy density Permeability- Field computation-Hysteresis-Reluctance and Permeance.

UNIT III ELECTROMAGNETIC WAVE PROPAGATION & APPLICATIONS 12

Maxwell's Equations : Faradays law - Concept of Displacement current-General field relations for time varying electric and magnetic fields-Maxwell's equations-Boundary relation for time-varying Fields - Retarded potentials-Phasor representation of a vector- Poynting vector and Poynting theorem

UNIT IV ELECTROMAGNETIC WAVE PROPAGATION 12

General Wave equations, Electromagnetic waves in free space-Electromagnetic wave equations in phasor form-Electromagnetic waves in perfect or (lossless) dielectric-Electromagnetic waves in lossy dielectric- Electromagnetic waves in good conductors.

UNIT V UNIFORM PLANE WAVES AND PROPAGATION 12

Uniform plane waves in free space, Wave Equation in phasor form, Uniform plane waves in perfect (lossless)dielectric, Uniform plane waves in lossy dielectric, Uniform plane waves in good conductor, Reflection of Uniform plane waves, Oblique Incidence-Polarization of Uniform plane waves, Surface Impedance

Total 60 Hrs

h) Learning Resources

Reference Books

1. Ramo, Whinnery and Van Duzer: " Fields and Waves in Communications Electronics" John Wiley & Sons Third edition, 2003
2. NarayanaRao, N: "Elements of Engineering Electromagnetics" Prentice Hall of India , New Delhi, Fourth Edition, 1998

Text Books

1. Matthew N.O.Sadiku: "Principles of Electro magnetics" Oxford University Press, Sixth edition, 2015
2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems." Prentice Hall of India, Second edition, 2003

Online Resources

1. http://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring 2008/
2. http://nptel.ac.in/courses/117103065/1