COURSE CODE: **1151EE201**	COURSE TITLE: **ELECTROMAGNETIC FIELDS**	L	T	P	C
		2	**0**	**2**	**3**

COURSE CATEGORY: Program Core

PREAMBLE :

The purpose of this course is to provide students with an introduction to the fundamentals of electrostatics, magneto statics, and electromagnetic waves. The bridge between electric circuits and electromagnetic is done through the study of transmission lines and their lumped-element model, transmission line input impedance, and power flow on lossless transmission line. This course also emphasizes the physical understanding and practical applications of electromagnetic in electronics.

PREREQUISITE COURSES:

Engineering Physics

RELATED COURSES:

Circuit Analysis, DC machines & Transformers, AC Machines

COURSE EDUCATIONAL OBJECTIVES :

The objectives of the course are to make the students,

- Provide an understand the fundamental nature of static electric fields, potential, flux, charge densities, static magnetic fields, steady current, resistance, capacitance, inductance, stored energy, materials, and boundary conditions.
- Make the students able to Solve simple boundary value problems, using the method of images and Poisson's equation.
- Impart Knowledge on the Basic laws that are governing the electromagnetic fields.
- Introduce the Concepts of electromagnetic waves and its sources

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	Explain about Electrostatics and sources of electric and magnetic fields	K2
CO2	Apply the knowledge of Magneto statics for application in machines	K3
CO3	Compare between Statics and Dynamically induced EMF	K2
CO4	Make use of Finite Element Method to solve field Equations	K3
CO5	Explain about Electromagnetic waves and their importance in transmission	K2

CORRELATION OF COs AND POs

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

COURSE CONTENT:

UNIT I	**ELECTROSTATICS-I**	**9**

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields – Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II	**ELECTROSTATICS-II**	**9**

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Applications.

UNIT III	**MAGNETOSTATICS**	**9**

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, Poisson's Equation, Applications

UNIT IV	**ELECTRODYNAMIC FIELDS AND SOLUTION OF FIELD EQUATIONS (FEM)**	**9**

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory –Applications.

UNIT V	**ELECTROMAGNETIC WAVES**	**9**

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector, Application

TOTAL: 45 PERIODS

EXPERIMENTS:

- Electric Field & Potential inside the parallel plate capacitor
- Magnetic field outside a straight conductor
- Magnetic field of coils
- Magnetic force on a current carrying conductor
- Magnetic Induction

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition, Oxford University Press In3.First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanathan ' Electromagnetic Field Theory (including Antennas and wave propagation', 16th Edition, Khanna Publications, 2007.

REFERENCE BOOKS:

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
2. William H. Hayt and John 1. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. D. K. Cheng, Field and Wave Electromagnetics, Addison-Wesley, 1992