

15EE205	Electromagnetic Theory			L	T	P	C
				3	0	0	3
<i>Co-requisite:</i>	NIL						
<i>Prerequisite:</i>	NIL						
<i>Data Book / Codes/Standards</i>	NIL						
<i>Course Category</i>	P	PROFESSIONAL CORE	CIRCUITS AND SYSTEMS				
<i>Course designed by</i>	Department of Electrical and Electronics Engineering						
<i>Approval</i>	32 nd Academic Council Meeting 2016						

PURPOSE	To acquire fair knowledge about the theoretical concepts and problems in Electromagnetic Fields						
INSTRUCTIONAL OBJECTIVES				STUDENT OUTCOMES			
At the end of the course, student will be able to							
1.	Understand the concepts of Electrostatics and their applications	a	e				
2.	Familiarize with the concepts of Magnetostatics and their applications	a	e				
3.	Learn the concept of Electromagnetic Fields, waves and wave propagation.	a	e	h			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: BASIC CONCEPTS OF FIELD THEORY	8			
1.	Introduction to various Co-ordinate Systems- Sources and effects of electromagnetic fields.	1	C	1	1,2,3,4
2.	Divergence theorem-Stokes theorem- Field theory and circuit theory comparison- Electric field intensity	2	C	1	1,2,3,4
3.	Electric fields due to point, line, surface and volume charge distributions – Electric flux density- Coulomb’s law	2	C	2	1,2,3,4
4.	Introduction to magnetic circuits – Magnetically induced EMF and Mechanical force, torque calculations	2	C	2	1,2,3,4
5.	Magnetic field in a rotating machine-generated voltage –induced EMF	1	C	2	1,2,4,3
	UNIT II: ELECTROSTATIC APPLICATIONS	9			
6.	Gauss’s law and its applications – Electric potential – potential gradient	2	C	1	1,2,3,4
7.	Electric field in free space, conductors, dielectric -Dielectric polarization	2	C	1	1,2,3,4
8.	Dielectric strength - Electric field in multiple dielectrics	1	C	1	1,2,3,4
9.	Boundary conditions, Poisson’s and Laplace’s equations	2	C	1	1,2,3,4
10.	Determination of Capacitance- Energy density problems.	1	C,D	1	1,2,3,4
11.	Methods of images, graphical field mapping	1	C	1	1,2,3,4
	UNIT III: MAGNETOSTATICS APPLICATIONS	10			
12.	Magnetic field due to straight conductors, circular loop, infinite sheet of current using Ampere and Bio-Savart law	2	C,D	2	1,2,3,4
13.	Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization	2	C	2	1,2,3,4
14.	Magnetic field in multiple media – Boundary conditions	2	C	2	1,2,3,4
15.	Scalar and vector potential –Design of Inductance – Energy density	2	C,D	2	1,2,3,4
16.	Application of magnetic circuits –. Energy in magnetic systems	2	C	2	7

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT IV: TIME VARYING ELECTRIC AND MAGNETIC FIELD FIELDS	8			
17.	Faraday's laws – Transformer and motional EMF-continuity current equation–Displacement current-conduction current	2	C	1	1,2,3,4,5
18.	Energy in quasi-stationary Electromagnetic Fields	2	C	1,2	1,2,3,4,5
19.	Maxwell's equations (differential, integral forms and sinusoidal variation of field with time)	2	C,D	1,2	1,2,3,4,5
20.	Potential for time varying fields, flow of power in electromagnetic field-Poynting vector	2	C	1	1,2,3,4,5
	UNIT V: ELECTROMAGNETIC WAVES	10			
21.	Electro Magnetic Wave equations – Wave parameters- velocity, intrinsic impedance-quantitative analysis propagation constant	1	C	3	1,2,3,4,5
22.	Electromagnetic Wave equation for free space, lossy and lossless dielectrics	2	C	3	1,2,3,4,5
23.	Wave equation for conductors-skin depth	2	C	3	1,2,3,4,5
24.	Plane wave reflection and refraction –incidence of plane wave at the boundary between two region ratio	2	C	3	1,2,3,4,5
25.	Input impedances – Standing wave–critical angle of incidence-Brewster angle	2	C	3	1,2,3,4,5
26.	Applications of electromagnetic waves-Introduction of bioelectromagnetics	1	C	3	6,3
	Total contact hours		45		

LEARNING RESOURCES

Sl. No.	TEXT BOOKS
1.	William Hayt, "Engineering Electromagnetics", McGraw Hill, New York, 7 th edition, 2014.
2.	Matthew. N.O. Sadiku, "Elements of Electromagnetics", Fourth Edition, Oxford University Press, 1 st Indian Edition, 2010.
REFERENCE BOOKS/OTHER READING MATERIAL	
3.	Ashutosh Pramanik, "Electromagnetism – Theory and Applications", Prentice-Hall of India Private Limited, New Delhi, 2006.
4.	Gangadhar.K.A, "Field theory", Khanna Publishers, New Delhi, 15 th edition, 2010.
5.	S C Mahapatra, "Principles Of Electromagnetics", McGraw Hill education private limited, 2011.
6.	John D. Kraus, "Electromagnetics with application" McGraw Hill, 5 th edition, 2011.
7.	Kothari D.P and Nagrath .I. J, "Electrical machines", Tata McGraw Hill Publishing Co. Ltd, New Delhi, 5 th edition, 2002

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	10%	15%	15%	5%	5%	50%
End semester examination Weightage :							50%