EE6302 ELECTROMAGNETIC THEORY L T P C 3 1 0 4

.

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, Capacitance, Energy density, 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, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 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 – Plane wave reflection and refraction – Standing Wave – Applications.

TOTAL (L: 45 +T: 15): 60 PERIODS

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc. 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. Ramanthan ' Electromagnetic Field Theory (including Antennaes and wave propagation', 16th Edition, Khanna Publications, 2007**.**

REFERENCES:

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 A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, FifthEdition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory Fundamentals",Cambridge University Press; Second Revised Edition, 2009.

Course Description and Aim

This subject develops the general theory of electromagnetism based on Maxwell's equations incorporating vector calculus; illustrates the theory using applications, for example in communications and in consumer electronics; and introduces practical techniques for solving problems in electromagnetism. The unit comprises the following topics: introduction to vector calculus; electrostatics—Gauss's Law, electric potential, polarisation, energy stored in an electric field, steady current flow, resistance and capacitance, boundary conditions, Poisson's equation and Laplace's equation; magnetostatics—Biot-Savart Law, Ampere's Law, magnetic scalar and magnetic vector potential, magnetisation, boundary conditions, energy stored in a magnetic field, inductance and mutual inductance; time-varying electromagnetic fields—Faraday's law, displacement current, Maxwell's equations, electric potential and vector potential under time-varying conditions; plane wave propagation—phasor description of time-harmonic waves, propagation constant, intrinsic impedance, plane waves in free space and in conducting materials, skin effect, Poynting vector, interface phenomena, reflection and transmission coefficients, standing waves, standing wave ratio; and Hertzian dipole

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday’s law, induced emf and Maxwell’s equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector

MICRO LESSON PLAN

Week	Hour	LECTURER TOPCS	Text/ Reference Books
	UNIT I ELECTROSTATICS-I		
I	1	Sources and effects of electromagnetic fields	T1
	2	Coordinate systems	T1
	3	Vector fields	T1
	4	Gradient, Divergence ,Curl	T1
	5	Theorems and applications (AV class)	T1
	6	Coulomb's Law	T1
II	7	Electric field intensity	T1
	8	Field due to discrete and continuous charges	T1
	9	Gauss's law and application (AV class)	T1
	10,11,12	Problems	T1
	UNIT II ELECTROSTATICS-II		
III	13	Electric potential	T1
	14	Electric field and equipotential plots ,uniform and non uniform field	T1
	15	Utilization factor- Electric field in free space	T1
	16	Electric field in conductors, dielectrics,	T1
	17	Dielectric polarization- Dielectric strength	T1
	18	Electric field in multiple dielectrics	T1
IV	19	Boundary conditions ,Poisson's and Laplace's equations	T1
	20	Capacitance	T1
	21	Energy density, Applications (AV class)	T1
	22,23,24	Problems	T1
	UNIT III MAGNETOSTATICS		
V	25	Lorentz force, magnetic field intensity	T1
	26	Biot–savart Law,	T1
	27	Ampere's circuit Law - H due to straight conductors	T1
	28	H due to circular loop, infinite sheet of current	T1
	29	Magnetic flux density– B in free space, conductor, magnetic materials	T1
VI	30	Magnetization – Magnetic field in multiple media	T1
	31	Boundary conditions, Scalar and vector potential	T1
	32	Poisson's equations Magnetic force – Torque	T1
	33	Inductance – Energy density –Applications (AV class)	T1
	34	Problems	
VII	35,36	Problems	T1
	UNIT IV ELECTRODYNAMIC FIELDS		
	37	Magnetic circuits-Faraday's laws	T1
	38,39	Transformer and motional EMF	T1
VIII	40	Displacement current	T1
	41,42,43	Maxwell's equations (differential and integral forms	T1
	44	Relation between field theory and circuit theory	T1

IX	45	Applications (AV class)	T1
	46,47,48	Problems	T1
	UNIT V ELECTROMAGNETIC WAVES		
	49	Electro Magnetic Wave generation and equations (AV class)	T1
	50	Wave parameters; velocity, intrinsic impedance, propagation constant	T1
X	51,52	Waves in free space , lossy dielectrics	T1
	53,54	Waves in lossless dielectrics , conductors	T1
	55	skin depth, Poynting vector	T1
XI	56	Plane wave reflection and refraction	T1
	57	Standing wave – Applications (AV class)	T1
	58,59,60	Problems	T1

Prepared by
Mr.K.ARCHUNARAJA
AP/EEE