KL UNIVERISTY
FIRST SEMESTER 2010-11
Course Handout
Academic Division

Dated: 07-07-2010

Course No. : EC C203
Course Title : Electro Magnetic Field Theory
Course Structure : 3-1-2
Course coordinator : Mr M Venkata Narayana
Instructors : K.PHANI SRINIVAS, P.POORNA PRIYA

1. Course Description:

Electro magnetic field Theory basically deal with the electric and magnetic fields characteristics. Thus while students studying electro magnetic fields should certainly have a solid foundation in disciplines based on the laws of physics. Electro magnetic fields course that bring electro statistics and magneto statistics concepts together in a unified way play an increasingly important role in the education of engineering students and in their preparation for current and future developments in their chosen fields.

2. Scope and Objective of the Course:

The theory of electromagnetism and Darwin's theory of Evolution represent the two greatest scientific syntheses of the nineteenth century. In the twentieth century and at the dawn of the twenty first, evolutionary theory has been at least partially integrated into the molecular approach to Biochemistry and Genetics, fields which continue to develop at an astonishing pace. Likewise, Electromagnetic theory, in addition to having incorporated the vast field of optical phenomena into its sphere of description, and having provided the initial seed of doubt for Einstein's development of Special Relativity theory, continues to flourish up to the present day. Generations old devices, such as the electric generator and motor, the radio transmitter and receiver, ac transformers, standard circuit elements, and the vacuum tube were all spawned subsequently to the fundamental discoveries and formulations of Electromagnetic theory. The realization that atomic and molecular properties were chiefly rooted in electromagnetic phenomena led to a formulation of atomic structure based on electromagnetic and classical mechanical principles. The failure of this model gave the impetus for the development of the Quantum theory of matter. The incorporation of electromagnetic principles into the quantum mechanical framework has illuminated a diverse array of phenomena in the solid, liquid, gaseous, nuclear, and plasma states, as well as in chemical and living states. Needless to say, such modern inventions as integrated circuits, lasers, and countless electro-optical devices are all the fruits of the continuous discovery, synthesis and interlocking of concepts that the discipline of Physics represents.

Unit I deals with principles of vector analysis and basic concepts of electrostatics like Charge distribution ,the concept of potential, capacitance and fundamental laws of Static electric charge.

Unit II deal with the fundamentals of study magnetic field, faraday law,Biot-savarts law, amperes law including the concept of vector magnetic potential and the energy density in magnetic field.

Unit III deals inconsistency of amperes law, equation of contuinity for time varying fields And also with maxwells equations for static and timevarying fields.

Unit IV deals with propagation of uniform plain waves, wave equation and it's general solution.the wave propagation in perfect and lossey dielectric along with poynting theorm are covered.

Unit V deals with the wave propagation between parallel planes and through the the rectangular wave guide

3. Books:

(i) Textbook:

a. 1.W.H. Hayt Jr , "Engineering Electromagnetic",MC Graw Hill – New York, 7th Edition
b. 2.GSN Raju, "Electromagnetic field Theory and Transmission Lines",Pearson Education Pvt. Ltd., New Delhi, 2005.

(ii) Reference Book:

1. EC.Jordan, "EM waves and Radiating systems", Pearson Education, 1997
2. Mathew no Sadiku, "Elements of Electromagnetics ", Oxford University Press, 2003.
3. Joseph A Edminister, "Theory and problems of Electromagnetics", 2nd edition, Scham's outline series, MC-Graw Hill International.

4. Syllabus:

UNIT – I ELECTRO – STATICS

Introduction to vector analysis, Types of charge distributions, coulomb's Law, Electric field intensity, Electric-field intensity due to different charge distributions, Potential and Potential difference, potential field of a point charge and a system of charges, potential gradient, the electric dipole, electric flux, electric flux density, gauss Law and applications, Divergence, theorem Poisson's and Laplace's equations. Capacitance of different configurations. Boundary conditions on E and D , energy density in Electrostatic field

UNIT – II MAGNETOSTATICS

Electric current, current densities, equation of continuity. Fundamentals of steady magnetic field, faraday's Law of Induction, Magnetic flux density, Magnetic field strength, B iot-savart's Law and applications, Ampere's work law or circuital law, differential form of Ampere's circuital law, stoke's theorem, Lorentt force equation, force on a current element in magnetic field, Ampere's force law, Boundary conditions on H and B, scalar and vector magnetic potentials, energy density in magnetic field.

UNIT – III MAXWELL'S EQUATIONS

Introduction, equation of continuity for time - varying fields, faraday's law, Inconsistency of Ampere's Law, the concept of displacement current, modified Ampere's circuital Law, Maxwell's equations for static fields and time – varying fields both in differential form of integral form. Maxwell's equations in phasor form for sinnsoildally tune – varying fields, Boundary conditions.

UNIT – IV ELECTRO – MAGNETIC WAVES

Introduction, wave equations for free space and conducting medium, Uniform plane wave equation, general solution of uniform plane wave equation, wave equations in phaser form, up wave propagation in free space, perfect dielectrics, lossy dielectric and good conductors skin effect.

Poynting vector and flow of power, complex Poynting vector.

UNIT-V GUIDED WAVES

Introduction: Waves between parallel plates, Derivation of field equations between parallel plates and propagation parameters, Field components for TE waves ($E_2 = 0$) , field components of TM waves ($H_2 = 0$), Propagation parameters of TE and TM waves, Guide wavelength. Transverse electromagnetic wave (TEM wave), velocities of propagation. Attenuation in parallel plane guides, wave impedances, waves in rectangular wave guides, Derivation of field equations in rectangular bellow wave guides, propagation parameters of TE and TM waves in rectangular wave guides.

5.Course Plan:

Lecture No	Learning Objectives	Topic	Chapter in Text Book
1	Define vectors and its properties. understand different basic laws	Introduction to vector analysis, Types of charge distributions, coulomb's Law	T-1, Chap-1
2	Understands different types of charge distributions and electric field intensity	Electric field intensity, Electric-field intensity due to different charge distributions,	T-1, Chap-1
3	Understands different types of potentials and their properties like gradients, potential fields etc	Potential and Potential difference, potential field of a point charge and a system of charges, potential gradient	T-1, Chap-1
4	Learn the definitions of electric dipole, electric flux, electric flux density,	the electric dipole, electric flux, electric flux density,	T-1, Chap-1
5	Understand the gauss Law and applications,	gauss Law and applications,	T-1, Chap-1
6	Derive the Divergence, theorem, and learn the poisons ratio and Laplace equations	Divergence, theorem Poisson's and Laplace's equations	T-1, Chap-3
7	Derive the Divergence, theorem, and learn the poisons ratio and Laplace equations	Divergence, theorem Poisson's and Laplace's equations	T-1, Chap-3
8	understands the different types of capacitors and their configurations	Capacitance of different configurations	T-1, Chap-3
9	Understand the boundary conditions of E,D	Boundary conditions on E and D , energy density in Electrostatic field	T-1, Chap-3
10	understands and derive the Electric current, current densities, equation of continuity	Electric current, current densities, equation of continuity	T-1, Chap-3
11	Under stand the steady magnetic fields fundamentals and learn the Faradays laws of motion	Fundamentals of steady magnetic field, faraday's Law of Induction	T-1, Chap-3
12	Evaluate the Magnetic flux density, Magnetic field strength equations	Magnetic flux density, Magnetic field strength	T-1, Chap-3

13	Analyze the B iot-savart's Law and applications	B iot-savart's Law and applications	T-1, Chap-3
14	Understand the different types of Ampere's law	Ampere's work law or circuital law, differential form of Ampere's circuital law,	T-1, Chap-4
15	Understand the properties of stokes's theorem, Lorentt force equation	stokes's theorem, Lorentt force equation	T-1, Chap-4
16	Understand the force on a current element in magnetic field	force on a current element in magnetic field	T-1, Chap-4
17	Understand the boundary conditions of H,B	Ampere's force law, Boundary conditions on H and B	T-1, Chap-4
18	To understand the magnetic potential vectors in magnetic fields	scalar and vector magnetic potentials, energy density in magnetic field.	T-1, Chap-9
19	Analyze the representation of time varying fields basing on equation of continuity	Introduction, equation of continuity for time - varying fields,	T-1, Chap-9
20	Understand the concept of faradays law and inconsistency of Ampere's Law	faraday's law, Inconsistency of Ampere's Law, the concept of displacement current,	T-1, Chap-9
21	Analyze the modified Ampere's circuital Law	modified Ampere's circuital Law	T-1, Chap-9
22	Analyze the Maxwell's equations for time – varying fields both in differential form of integral form	Maxwell's equations for static fields and time – varying fields both in differential form of integral form.	T-1, Chap-2
23	Analyze the Maxwell's equations for time – varying fields both in differential form of integral form	Maxwell's equations for static fields and time – varying fields both in differential form of integral form.	T-1, Chap-2
24	Analyze the Maxwell's equations for sinnsoildally tune – varying fields	Maxwell's equations in phasor form for sinnsoildally tune – varying fields	T-1, Chap-9
25	Analyze the Maxwell's equations for sinnsoildally tune – varying fields	Maxwell's equations in phasor form for sinnsoildally tune – varying fields	T-1, Chap-9
26	Understand the boundary conditions	Boundary conditions.	T-1, Chap-7
27	Understand the concept of electro-magnetic waves	Introduction,	T-1, Chap-7
28	Analyze the wave equations for free space conducting medium	wave equations for free space and conducting medium	T-1, Chap-7
29	Understand the concept of Uniform plane wave equation	Uniform plane wave equation	T-1, Chap-10
30	Analyze the general solution of uniform plane wave equation	general solution of uniform plane wave equation	T-1, Chap-10

31	Evaluate the wave equations in phasor form	wave equations in phasor form	T-1, Chap-10
32	Understand the concept of up wave propagation in free space	up wave propagation in free space,	T-1, Chap-10
33	Understand and characterization of perfect dielectrics	perfect dielectrics	T-1, Chap-10
34	Understand and characterization of lossy dielectric and good conductors skin effect**.**	Lossy dielectric and good conductors skin effect**.**	T-1, Chap-10
35	Derive the Pointing vector and flow of power	Pointing vector and flow of power	T-1, Chap-10
36	Analyze the properties complex Pointing vector.	Complex Pointing vector.	T-1, Chap-10
37	Introduce the concept of Waves between parallel plates,	Introduction: Waves between parallel plates,	R-1, Chap-10
38	Evaluate field equations between parallel plates and understand the propagation parameters	Derivation of field equations between parallel plates and propagation parameters	R-1, Chap-10
39	Analysis and characterization of TE waves and TM waves	Field components for TE waves ($E_2 = 0$) ,field components of TM waves ($H_2 = 0$)	R-1, Chap-10
40	To understand the representation of Propagation parameters of TE and TM waves	Propagation parameters of TE and TM waves	R-1, Chap-5
41	Evaluate the Guide wavelength. And understand Transverse electromagnetic wave (TEM wave),	Guide wavelength. Transverse electromagnetic wave (TEM wave),	R-1, Chap-5
42	Evaluate the Velocities of propagation. Attenuation in parallel plane guides, wave impedances	Velocities of propagation. Attenuation in parallel plane guides, wave impedances	R-1, Chap-5
43	Evaluate the waves in rectangular wave guides, Derivation of field equations in rectangular bellow wave guides	waves in rectangular wave guides, Derivation of field equations in rectangular bellow wave guides	R-1, Chap-5
44	Understand the propagation parameters of TE and TM waves in rectangular wave guides.	propagation parameters of TE and TM waves in rectangular wave guides.	R-1, Chap-5
45	Understand the propagation parameters of TE and TM waves in rectangular wave guides.	propagation parameters of TE and TM waves in rectangular wave guides.	R-1, Chap-5

6.Self learning material:

S.no	Unit	Topic	Source
1	I	Types of charge distributions, coulomb's Law	T2
2	I	Capacitance of different configurations	T2
3	II	stokes's theorem	T1
4	III	Faraday's law,	T1
5	IV	perfect dielectrics	T1
6	V	Velocities of propagation	T2

7.Evaluation Scheme:

Component	Duration (minutes)	% Weightage	Marks	Date & Time	Venue
Test-1	50 Min	8	10	11.08.10 09.30 to 10.20 AM	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Test-2	50 Min	8	10	15.09.10 09.30 TO 10.20 AM	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Assignement submission		4	5	Continuous	
Assignment Test	50 Min	4	5	27.10.10 09.00 to 10.20 AM	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Quiz	30 Min	4	5	27.10.10 09.00 to 10.20 AM	CSE001,002, 004, 005, 101, 102,104,105, 106,201,204, 205,301,502, 509, NSH
Regular Lab Evaluation	Continuous	10	50		
Comprehensive Lab Exam	3 Hrs	8	40		
Comprehensive Exam	3 Hrs	48	60		
Attendance for Theory & Tutorial		4	5	Continuous	
Attendance for Lab		2	10	Continuous	

8. Chamber consultation hour: Informed in the class in first week.

9. Notices: All notices regarding the course will be put in E-learning website.

10.Tutorial: Tutorial will be conducted by the respective in charge faculty. The tutorials are planned to supplement the material taught in the lectures and clear doubts. Student must attend registered section for tutorial in the respective classroom. Class assignment, class tests and other evaluation components will also be conducted during tutorials. Students must actively participate in the tutorial and come prepared for it.

Course Coordinator