BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI (Rajasthan)
FIRST SEMESTER 2016-2017
Course Handout (Part II)

Date: 02/08/2016

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	**:**	**INSTR F212**
Course Title	**:**	**ELECTROMAGNETIC THEORY**
Instructor-in-charge	**:**	**Navneet Gupta (Chamber No. 2210-H)** (email: ngupta@pilani.bits-pilani.ac.in)
Instructors	:	Dheerendra Singh, Praveen Kumar A V, Kavindra Kandpal, Harshavardhan S, Rajneesh Kumar

1. Scope and objective of the course:

Electromagnetics is one of the most fundamental topics in electrical engineering. Maxwell's four simple equations form the basis for almost all phenomena in Electrical and Communication Engineering. Thorough understanding of many areas of microelectronics, machines and communication depends upon electromagnetics. Emphasis will be placed on physical concepts and applications in the field of wave propagation. An effort will be made to show that electromagnetic is not a dull and dry area with lot of mathematics but something beyond it. The objective of this course is to provide the students with a secure and sufficient background for understanding and analyzing basic electromagnetic phenomenon as well as prepare them for more advanced subjects in electromagnetic theory.

2. Text Book:

David K.Cheng, "*Field and Wave Electromagnetics*" 2nd ed. Pearson Education, New Delhi, 2009.

3. Reference Books:

(i) Matthew N.O.Sadiku, "*Principles of Electromagnetics*" 4th ed. Oxford University Press, New Delhi.
(ii) John D. Kraus and Daniel A. Fleisch, "*Electromagnetics*", 5th ed., McGraw-Hill, New Delhi.

4. Course Plan :

Lec. No.	Topic to be covered	Learning Objective	Ref. To TB
1-3	Vector Algebra, coordinate systems and vector calculus	To apply the mathematical tools useful for understanding the concepts of EM Field theory	2.2-2.12
4-6	Static Electric Fields	To use the source-free relationships in electrostatics	3.2-3.5
7-8	Properties of materials, Polarization in dielectrics and boundary conditions	To describe the behavior of conductors and dielectrics in static electric field	3.6-3.9
9-10	Poisson's and Laplace's Equations; Method of images	To apply the techniques for solving boundary-value problems	4.2-4.4
11-12	Current density, equation of	To understand the importance of current density	5.2, 5.4-

	continuity, Boundary conditions	and know the boundary conditions	5.7
13	Magnetostatics ; magnetic potentials	To describe fundamental postulates of magnetostatics	6.2-6.4
14-15	Magnetic dipoles, Magnetization and Boundary conditions	Differentiate between magnetic dipole & electric dipole and to solve problems concerning magnetic fields having media with different properties	6.5, 6.7 & 6.10
16	Magnetic Forces & Materials	To calculate the forces and torques on current-carrying conductors	6.13.2
17-18	Time-Varying Fields and Maxwell's Equations, time harmonic fields	To describe how time-varying fields leads to generation of electromagnetic waves which are governed by four Maxwell's equations	7.1-7.4, 7.7
19-20	Plane wave propagation in different media and Wave polarization	To describe the propagation of waves through space and various kinds of media and to understand various types of polarization	8.1-8.2
21-22	Ionized Media; Phase and Group velocity	To explain the significance of ionized media in communication and to understand the concept and correlation between phase and group velocity	8.3-8.4
23	Flow of Electromagnetic Power and Poynting Vector	To study about the storage of EM energy	8.5
24-26	Reflection & refraction of EM waves at the interface	Behaviour of plane waves at the interface between two media and multiple interfaces	8.6-8.10
27-30	Theory of Transmission lines and Finite Transmission lines	To derive general transmission line (TL) equations and to study the wave characteristics on finite TL.	9.3-9.4
31-34	Smith Chart and its applications	To solve transmission line problems using Smith Chart	9.6-9.7
35-37	Antenna and Radiating Systems	To identify, how wireless transmission of information takes place over long distances.	11.1-11.4
38-40	Bioelectromagnetics and Electromagnetics Hazards	To study TL in nervous systems, retinal optic fibers, heart dipole field, cardiac pacemakers and effects of EM waves in the environment	Lec. Notes

5. Learning Outcomes:

After completing this course student shall be able to:

- Differentiate between the circuit theory concept and electromagnetic theory concept.
- State several laws and principles of electric, magnetic, and electromagnetic fields.
- Use vector calculus and other mathematics to describe electromagnetic phenomena.
- Formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media, and also solve such problems in simple geometries using method of images.
- Describe and make calculations of plane electromagnetic waves in simple (linear, isotropic and homogeneous) media and boundary conditions at the interface between two media.
- Describe and analyze distributed systems such as transmission lines and fields.
- Apply the concept of electromagnetic theory in the area of wireless communication system.

6. Evaluation Scheme:

Component	Duration	Marks (200)	Weightage	Date & Time	Evaluation Type
Mid-Sem. Test	90 min	60	30%		Closed Book
Take Home / Assignment	--	20	10%	(one before & second after Mid-sem test)	Open Book
Quizzes	10 min	40	20%	During Tutorial Hour	Closed Book
Comprehensive Examination	3 hours	80	40%	01/12/2016 (FN)	(20%) Open + (20%) Closed Book

7. Chamber Consultation Hour: Thursday 4:50-5:50 pm

8. Notices: All notices will be put up on EEE Notice Board and on NALANDA.

9. Make-up Examination: Make-up will be given **ONLY** in cases of **sickness (hospitalization)** or **urgency** for going out of station.

Instructor-in-charge
EEE F212/INSTR F212