



Course Handout (Part II)

Date: 07/01/2016

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. : **EEE F433**
Course Title : **Electromagnetic Fields and Waves**
Instructor-in-charge : **Dr. NAVNEET GUPTA (chamber No. 2210-H)**
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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 such as VLSI, PCBs operating at GHz clocks, rotating machines, microwaves and antennas depends upon electromagnetics. EM is also important in biomedical engineering, nondestructive testing, electromagnetic compatibility and interference analysis, microelectromechanical systems (MEMS) and many more areas. This course is an advanced course on electromagnetics. Students opting for this course must have thorough electromagnetic theory. The objective of this course is to provide the students the in-depth knowledge of electromagnetic fields and waves and various applications utilizing EM waves.

2. Text Book:

John D. Kraus and Daniel A. Fleisch, "Electromagnetics", 5th ed., McGraw-Hill, New York, 1999.

3. Reference Books:

- (i) N.N.Rao, "Fundamental of Electromagnetics for Engineering" 6th impression, Pearson Education, New Delhi, 2009. **(R1)**
- (ii) Matthew N.O.Sadiku, "Principles of Electromagnetics" 4th ed. Oxford University Press, New Delhi, 2009. **(R2)**
- (iii) R.K.Shevgaonkar, "Electromagnetic Waves" , Tata McGraw-Hill Publishing Company Ltd., 2006.**(R3)**

4. Course Plan:

| Lec. No. | Topic to be covered | Learning Objective | Reference |
|----------|---|---|-----------------------------|
| 1 | Course handout discussion | Introduction and the importance of the course | Lecture class |
| 2-5 | Maxwell's Equations in integral and differential form | Fundamental laws, relations and equations in Electromagnetics, Maxwell's equations, Boundary conditions | Ch.2 |
| 6-7 | Relation between field and circuit theory | Understand how the two approaches are related to each other | 3.2, 3.3 (TB) |
| 8-10 | Transmission lines analysis | Analysis of transmission lines and their circuit behaviour | 3.4 (TB) |
| 11-16 | Terminated Transmission lines Smith Chart and impedance matching | To solve transmission line problems, to provide the matching network and calculate bandwidth using Smith Chart, | Lecture Class, 3.4-3.5 (TB) |





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|-------|---|---|---|
| 17-21 | Wave propagation in free space, conducting and dielectric media and at interfaces | Understand the propagation of waves through space and various kinds of media, Boundary conditions, poynting vector, Wave polarization | 4.2-4.12 (TB) Ch 4 and 5 (R1) |
| 22-23 | Reflection & refraction of plane waves | Oblique incidence with perpendicular and parallel polarization case | 4.14 (TB) |
| 24-28 | Waveguides and Cavity Resonator | To understand the general Wave behaviour along uniform guiding structures, TEM waves, TM waves, TE waves, different types of wave guides and cavity resonator | 8.1-8.4 (TB) and R1 |
| 29-34 | Basics of Antennas and Radiating Elements | Antenna parameters, basic antenna elements, Antenna Equivalent circuit, Retarded Potential, Hertzian dipole Half wave dipole, Antenna arrays | 5.2-5.3(TB), 5.5, 5.8 |
| 34-37 | Antenna Types | Small loop antenna, Slot antenna, Helical antenna and Log periodic antenna, frequency selective surfaces (FSS) | Lecture Class and 5.4-5.9 (TB), 5.10, 5.12(part) (TB) |
| 38-40 | Supplementary Topics | Wave propagation in ionized medium, Electromagnetic Compatibility and shielding, EM Waves hazards | 10.5 (TB), Ch 10 (R1) and Lecture Class |

5. Evaluation Scheme:

| Component | Duration | Marks (200) | Weightage | Date & Time | Evaluation type |
|---------------|-----------|-------------|-----------|----------------------|--------------------|
| Mid-Sem Test | 90 min | 70 | 35% | 14/3 9:00 - 10:30 AM | Closed Book |
| Quiz | 10 min | 30 | 15% | Surprise | Closed Book |
| Assignment | Take Home | 15 | 7 % | | Open Book |
| Compre. Exam. | 3 hours | 85 | 43% | 3/5 FN | Closed + Open Book |

6. Chamber Consultation Hour: To be announced in the class

7. Notices: EEE Notice Board (in FD-II) and on NALANDA

8. Make-up Examination:

Make-up will be given **ONLY** in cases of **sickness (hospitalization)** or **urgency** for going out of station. (no make-up will be given for assignments and surprise quizzes).

Instructor-in-charge
EEE F433

