BITS-Pilani, Hyderabad Campus

First Semester 2016 – 2017

Course Handout (Part - II)

Date: 22/07/2016

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

Course Number : **EEE F474**
Course Title : **Antenna Theory and Design**
Instructor-in-Charge : **S. R. Zinka**

1. Scope and Objective of the Course:

To provide the fundamental knowledge about the antenna design which is the key subject of radar, wireless communication and mobile communication. The main objective of this course is to introduce theory, analysis, design and measurements of antennas. First, the electromagnetic theory is introduced and the fundamental antenna parameters are explained. Classical radiating elements; dipoles/monopoles, loops, apertures, horns, reflectors and modern antennas like microstrip patch antennas (MPAs) and fractal antennas are included to meet the cutting-edge requirement of this field. Considerable special attention is also planned to antennas popular in mobile telecommunications. Antenna simulations through professional software will be taken through seminars.

2. Text Books:

C.A. Balanis, Antenna Theory, Analysis and Design, 3rd ed., John Wiley and Sons 2005.

3. Reference Books:

a) J. D. Kraus and R. J. Marhefka, Antennas, 3rd ed. McGraw-Hill, 2002.
b) W. L. Stutzman and G. A. Thiele, Antenna Theory and Design, 2nd ed. Wiley, 1998.
c) S.J.Orfanidis, Electromagnetic Waves and Antennas; Online Book by Reuters Univ., 2005

4. Course Plan:

Lec. No.	Topic	Learning Objective	Reference
1 – 2	Introduction to antenna theory, review of Maxwell's equations and electromagnetic wave theory, Smith Chart and impedance matching	To recall the basics of EM theory to useful to discuss antenna theory	Chapter 1
3	Radiation integrals and auxiliary potential functions	To derive potential functions	3.1 – 3.6
4 – 8	Antenna Arrays; linear arrays, planar arrays. N-Element Linear Array	To describe the various linear antenna arrays	6.1 – 6.5; 6.8
8 – 10	Basic radiator; short dipoles, half wave dipoles, loop antennas	To explain the analysis and parameters of basic radiators	4.1 – 4.3; 4.6 & 5
11 – 12	Antenna parameters: Radiation pattern, power density, radiation intensity, beamwidth, Directivity, Antenna Efficiency and Gain etc.	To describe parameters used to evaluate the properties of antenna.	2.1 – 2.11
13 – 14	Antenna Polarization, Antenna Equivalent circuit, Friis transmission and Radar range equation	To derive polarization and Friis transmission equation	2.12 – 2.17
15 – 16	Demonstration of Commercial Software Packages for antenna design; CST and HFSS software tools.	To demonstrate the antenna design software tools	Software Tools
17 – 18	Aperture antennas: Huygen's principle, rectangular apertures	To explain the Huygen's principle for aperture antennas	12.2, 12.5
19 – 21	Horn Antennas: E-Plane, H-Plane,	To analyze the performances of horn antennas	Ch 13

	Pyramidal and conical corrugated horn		
22 – 24	Microstrip antennas analysis and design; general characteristics, radiation mechanism feeding techniques, rectangular patch.	To explain the theory and radiation mechanism of patch antennas	14.1 – 14.2
25 – 26	Q-factor, bandwidth and Efficiency. Input impedance & circular polarization techniques. Patch Antenna arrays	To evaluate the performance of patch antenna on the basis of Q-factor, BW & eff.	14.3 – 14.8
27 – 29	Traveling wave and Broadband Antennas (Helical and Yagi-Uda antennas)	To discuss important broadband antennas	10.2 – 10.3
30 – 32	Frequency Independent Antennas (FIA): Spiral antennas and Log-periodic antenna Fractal antennas	To learn some important types of FIA	11.3 – 11.4, 11.6
33 – 37	Parabolic Reflector antenna and Smart antennas, Cellular radio system evolution,	To describe the smart antennas	15.4 & 16
38 – 42	Antenna Measurements; antenna ranges, radiation pattern, gain, polarization and antenna efficiency. Comparison between MPA and DRA	To measure the various antenna properties	17.1 – 17.9
		Total no. of classes planned	42

5. Evaluation Scheme:

Component	Duration	Weightage	Marks	Date & Time	Remarks
Test I	60 mts.	15%	30	13/9, 2:30 – 3:30 PM	Closed Book
Test II	60 mts.	15%	30	21/10, 2:30 – 3:30 PM	Closed Book
Term Project		20%	40		Open Book
Regular Lab		10%	20		Open Book
Take Home Lab Exam		10%	20		Open Book
Comprehensive	3 Hrs	30%	60	13/12 AN	Closed
Total		**100%**	**200**		

6. Chamber Consultation Hour: To be announced in Class

7. Make-up Policy: Make-up will be given on extremely genuine grounds only. Prior application should be made for seeking the make-up examination.

8. Notices: Notices, if any, concerning the course will be put up on CMS only.

Instructor-in-Charge
EEE F474