**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI,**

**HYDERABAD CAMPUS**

**Second Semester 2021 – 2022**

**Course Handout (Part - II)**

**Date: Jan 15, 2022**

**Course Number : EEE F474**

**Course Title : Antenna Theory and Design**

**Instructor-in-Charge : Harish V. Dixit**

**Course Description:**

Introduction of Antenna theory; Antenna parameters: Radiation pattern, power density, radiation intensity, beamwidth, Directivity, Antenna Efficiency and Gain etc; Antenna Polarization, Antenna Equivalent circuit, Friis transmission and Radar range equation; Radiation integrals and auxiliary potential functions; Basic radiator; short dipoles, half wave dipoles, Monopole antenna, loop antennas; Antenna Arrays; linear arrays, planar arrays. N-Element Linear Array; Antenna Synthesis: Schelkunoff Polynomial Method, Fourier Transform Method; Traveling wave and Broadband Antennas (Helical and Yagi-Uda antennas); Frequency Independent Antennas (FIA): Spiral antennas and Log-periodic antenna Fractal antennas; Aperture antennas: Huygen’s principle, rectangular apertures; Horn Antennas: E-Plane, H-Plane, Pyramidal and conical horn; Microstrip antennas analysis and design; general characteristics, radiation mechanism feeding techniques, rectangular patch.; Q-factor, bandwidth and Efficiency. Input impedance & circular polarization techniques. Patch Antenna arrays; Parabolic Reflector antennas.

**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.

1. **Text Books:**

TB 1 C.A. Balanis, Antenna Theory, Analysis and Design, 3rd ed., John Wiley and Sons 2005.

1. **Reference Books:**
2. J. D. Kraus and R. J. Marhefka, Antennas, 3rd ed. McGraw-Hill, 2002.

**4. Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lec. No.** | **Topic** | **Learning Objective** | **Chapter in the Text Book** |
| 1 –10 | Introduction to antenna and antenna parameters | To recall the basics of EM theory to useful to discuss antenna theory | TB 1 and class notes |
| 11-18 | Dipole and monopole antennas | To explain the analysis and parameters of basic radiators | TB1 and class notes |
| 19-25 | Antenna arrays-linear, planar etc. and their synthesis | To discuss antenna synthesis process | TB 1 and class notes |
| 26-30 | Broadband antennas and frequency independent antenna | To discuss important broadband antennas | TB1 and class notes |
| 30-35 | Waveguide and microstrip antenna | To analyze the performances of horn antennas | TB1 and class notes |
|  |  | To explain the theory and radiation mechanism of patch antennas |  |
| 35-42 | Advanced antenna topics | Advanced topics in antenna design and analysis | TB1 and class notes |
|  |  | Total no. of classes planned | 42 |

**The primary reference for the coverage (breadth and depth)/nomenclature/notations for a particular topic would be as per the lectures/tutorials. Students are strongly advised to take class notes during the online lectures.**

**5. Evaluation Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage** | **Date & Time** | **Nature of Component** |
| Mid Term Test | 90 mins. | 30% | 11/03 3.30pm to5.00pm | Open Book |
| Lab/Assignment | Continuous | 25% | Ongoing | Open book |
| Classroom interaction | continuous | 5% |  | -- |
| Comprehensive | 120 mins | 40% | 10/05 AN | Open Book |

**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.

9. It is presumed that students have access to reliable broadband internet connection and a desktop pc/laptop.

**10. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Harish V. Dixit

**Instructor-in-Charge**

**EEE F474**