ANTENNA THEORY AND TECHNIQUES
(Elective Subject)

Course Code:	13M1WEC334	**Semester:**	3rd Semester, M. Tech (ECE)
Credits:	3	**Contact Hours:**	L-3

Course Objectives

1. Understanding of antenna fundamentals
2. Ability to design, synthesize and analyze the performance of various antenna types.

Course Outcomes

1. The ability to understand important and fundamental antenna engineering parameters and terminology.
2. To learn the basic concepts of electromagnetic wave radiation and reception.
3. Be familiar with important classes of antennas and their properties and to gain the ability to pick a particular class of antenna for given specifications.
4. To develop the basic skills necessary for designing a wide variety of practical antennas and antenna arrays.
5. Be familiar with techniques for estimating the propagation performance of a communication channel.
6. Be able to define specifications for a communications system based on a set of requirements.

Course Contents

Unit	**Topics**	**References (chapter number, page no. etc)**	**Lectures**
1.	Electromagnetic Radiation: Radiation phenomenon from an oscillation dipole in free space, induction and radiation fields, Retarded potentials, Radiated power and radiation resistance from a short dipole , half wave dipole and quarter wave monopole.	C. A. Balanis J. D. Kraus and R. J. Marhefka	
2.	Antenna Basics: Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization linear polarization, circular and elliptic polarization, antenna temperature and Reciprocity properties of antennas, Friss equation.	C. A. Balanis J. D. Kraus and R. J. Marhefka	
3	Auxilliary Potentials Functions and Linear Wire Antennas: Vector potential A and F, Electric and Magnetic Fields for Electric and Magnetic	C. A. Balanis J. D. Kraus and R. J. Marhefka	

	Current sources, Duality Theorem, Reciprocity and Reaction Theorem, Infinitesimal Dipole, Finite length dipole, Half wave dipoles.		
4	Antenna Arrays: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays) of n-point sources, directivity and beam width.	C. A. Balanis J. D. Kraus and R. J. Marhefka	
5	Antenna Arrays: Analysis and Synthesis: Linear arrays, circular array, planar (2D) arrays, sum and difference patterns, Effect of mutual couplings, Phased array antennas, scan principles, Non-uniform arrays, Dolph-Chebyshev Arrays, Binomial Arrays.	C. A. Balanis J. D. Kraus and R. J. Marhefka	
6	Analysis and Design of Anteena: Resonant Antennas: Wires and Patches, Yagi - Uda Antennas, Micro strip Antenna, horn antennas, Parabolic reflector antenna principles, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, matching the feed to the reflector, general feed model, feed antennas used in practice. Broad band Antennas: Traveling - wave antennas, helical antennas, Biconical antennas, sleave antennas, and Principles of frequency - independent Antennas, spiral antennas, Log – Periodic antenna, fractal antenna.	C. A. Balanis J. D. Kraus and R. J. Marhefka	
		Total Number of Lectures	

Evaluation Scheme

1. Test 1 : 15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
   - 10 Marks : Class performance, Tutorials & Assignments
   - 10 Marks : Quizzes
   - 5 marks : Attendance

Text Book

1. Antenna Theory Analysis and Design, C. A. Balanis, 3rd Ed, 2005, John Wiley & Sons Inc.

2. Antennas for All Applications, J. D. Kraus and R. J. Marhefka, 3rd Ed., 2002, McGraw-Hill, Inc.

Reference Books

1. Antennas and Radio wave Propagation, R. E. Collin, 1985, McGraw-Hill, Inc.
2. Antenna Theory and Microstrip Antennas, D. G. Fang, 2010, CRC Press.
3. Electromagnetic waves and Radiating Systems, E. C. Jordan and Balmain, Pearson Education.