

ANTENNAS AND WAVE PROPAGATION

V Semester: ECE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AECB18	Core	L	T	P	C	CIA	SEE	Total
		2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 45			
I. COURSE OVERVIEW:								
This course will cover the fundamentals of antenna, radiation phenomenon, different types of antennas, antenna arrays, antenna measurements and wave propagation (influence of earth's atmosphere on radio waves). Antennas have a wide range of application in government and commercial fields and are able to design antennas like Yagi-Uda and microstrip.								
II. OBJECTIVES:								
The course should enable the students to:								
I Principles of radiation, antenna parameters and working principle of VHF, UHF and microwave antennas used in communications, broadcasting, radar, navigation and similar systems.								
II Familiarize with basic antenna types and common structures, measurement of antenna characteristics and application of antennas over the radio frequency (RF) to microwave (MW) frequency range.								
III The applications of smart, wideband and ultra wideband antennas for wireless communications, satellite communication, and radar systems.								
III. COURSE OUTCOMES:								
After successful completion of the course, students should be able to:								
CO 1 Illustrate the radiation mechanism in wire antennas and retarded potentials using Maxwell's equations. Understa								
CO 2 Interpret the radiation characteristics of Yagi-Uda, horn and helical antennas using radiation pattern in far field region. Understa								
CO 3 Analyze the radiation characteristics of microstrip and microwave antennas using electric field distribution. Analyz								
CO 4 Identify the radiation patterns of arrays using principle of pattern multiplication. Apply								
CO 5 Examine the performance of antennas using the radiation pattern, directivity and gain. Analyz								
CO 6 Select the modes of wave propagation using refraction and reflection concepts Apply								
IV. SYLLABUS:								
MODULE - I	ANTENNA BASICS					Classes: 09		
Antenna fundamentals: Introduction, Basic Antenna Parameters-Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height, illustrative Problems, Fields from Oscillating Dipole, Field Zones, Front-to-Back Ratio, Antenna Theorems, Radiation, Retarded Potentials, Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole, Current Distributions, Field Components, Radiated Power, Radiation Resistance, Loop Antennas- Introduction, Small circular Loop, Comparison of Far Fields of Small Loop and Short Dipole.								

MODULE -II	VHF,UHF AND MICROWAVE ANTENNAS-I	Classes: 10
Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas-Helical Geometry, Helix modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.		
MODULE -III	VHF,UHF AND MICROWAVE ANTENNAS-II	Classes: 10
Microstrip Antennas-Introduction, Basic characteristics of micro strip antennas, Feeding Methods, Methods of Analysis, Rectangular and Circular micro strip antennas, Basic concepts of Smart antennas, concepts and benefits of smart antennas, fixed weight beam forming, adaptive beam forming. Reflector Antennas- Introduction, Paraboloidal Reflectors- Geometry, Pattern Characteristics, Feed Methods Lens Antennas:Introduction, Geometry of Non-metallic Dielectric Lenses ,Zoning, Tolerances, Applications, Slot Antenna, Babinet's Principle, Applications.		
MODULE -IV	ANTENNA ARRAYS AND MEASUREMENTS	Classes: 08
Antenna Arrays: Point Sources- Definition, Patterns, Arrays of 2 Isotropic Sources – Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays- Broadside Arrays, End-fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-Uniform Amplitude Distributions, General considerations and Binomial Arrays, Illustrative Problems Antenna Measurements: Introduction, Concepts – Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors Patterns to be Measured, Pattern Measurement Arrangement Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)		
MODULE -V	RADIO WAVE PROPAGATION	Classes: 08
Wave Propagation - I: Introduction, definitions, categorizations ,different Modes of Wave Propagation; Ground wave propagation: Introduction, plane earth reflections, , wave tilt, curved earth reflections; Space wave propagation: Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, super refraction, M-Curves, duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations; Wave propagation – II: Sky wave propagation: Introduction, structure of ionosphere, refraction and reflection of sky waves by ionosphere; Ray path, critical frequency, MUF, LUF, OF, virtual height and skip distance; Relation between MUF and skip distance; Multi-hop propagation.		
Text Books:		
1. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, "Antennas and Wave Propagation", TMH, 4 th Edition, 2010. 2. C.A. Balanis, "Antenna Theory", John Wiley and Sons, 2 nd Edition, 2001.		
Reference Books:		
1. E.C. Jordan, K.G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2 nd Edition, 2000. 2. E.V.D. Glazier, H.R.L. Lamont, "Transmission and Propagation", Her Majesty's Stationery Office, 1958. 3. F.E. Terman, "Electronic and Radio Engineering", McGraw-Hill, 4 th Edition, 1955. 4. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech India Publications, 1 st Edition, 2001.		

Web References:

1. [http:// web.stanford.edu/class](http://web.stanford.edu/class)
2. <http://www.electronicagroup.com>
3. <http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html>
4. <http://nptel.ac.in/courses/antennas>

E-Text Books:

1. <http://www.ebookgalaxy.in/2016/01/antennas-and-wave-propagation-by-g-s-n.html#.WBG17NJ97IU>
2. <https://www.jntubook.com/antennas-wave-propagation-textbook>
3. http://117.55.241.6/library/E-Books/Antennas_mcgraw-hill_2nd_ed_1988-john_d_kraus.pdf
4. <http://www.archive.org>