

Course Code	Course Title					Core/Elective	
PC602EC	<b>ANTENNAS AND WAVE PROPAGATION</b>					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EMTL PC404EC	3	1	-	-	30	70	3

**Course Objectives:**

1. To familiarize the students with the basic principles of antennas and introduce the antenna terminology.
2. To introduce different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
3. To familiarize with the design of different types of antennas for various frequency ranges and latest developments in the practical antennas.
4. To introduce need for antenna arrays and the concepts of measurements of antennas.
5. To introduce the various modes of Radio Wave propagation used.

**Course Outcomes:**

- To illustrate the basic principles of antennas and learn the antenna terminology.
- To design different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
- To design different types of antennas for various frequency ranges and get updated with latest developments in the practical antennas.
- To apply the principles of antennas, to design antenna arrays and measure various parameters of antennas.
- To Identify and understand the suitable modes of Radio Wave propagation used in current practice

**UNIT - I**

Introduction, Fundamental Concepts- Physical concept of radiation, Radiation pattern, Isotropic Radiator, Front-to-back ratio, Antenna Field Regions, Radiation Intensity, Beam Area, Beam Efficiency, Reciprocity, Directivity and Gain, Antenna Apertures, Antenna Polarization, Antenna impedance, Antenna temperature, Friis transmission equation, Retarded potential.

**UNIT - II**

Current Distributions, Radiation from Infinitesimal Dipole, Half wave Dipole and Quarter wave Monopole, Loop Antennas - Introduction, Small Loop, Far field pattern of circular loop with uniform current, Comparison of far fields of small loop and short dipole, Slot Antennas, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes, wideband characteristics, radiation efficiency.

**UNIT - III**

V-antenna, Rhombic Antenna, Yagi-Uda Antenna, Folded Dipoles & their Characteristics, Log-periodic Antenna, Aperture Antennas- Huygens' principle, Radiation from apertures, Babinet's principle, Radiation from Horns and design considerations, Parabolic Reflector and cassegrain Antennas, Lens Antennas, Micro Strip Antennas- Basic characteristics, feeding Methods, Design of Rectangular Patch Antennas, Smart Antennas- Fixed weight Beam Forming basics and Adaptive Beam forming,

**UNIT - IV**

Array of point sources, two element array with equal and unequal amplitudes, different phases, linear n- element array with uniform distribution, Broadside and End fire arrays, Principle of Pattern Multiplication, Effect of inter element phase shift on beam scanning, Binomial array.

**Antenna Measurements:** Introduction, Antenna Test Site and sources of errors, Radiation Hazards, Patterns to be Measured, Radiation, Gain and Impedance Measurement Techniques.

**UNIT - V**

Ground wave propagation, Space and Surface waves, Troposphere refraction and reflection, Duct propagation, Sky wave propagation, Regular and irregular variations in ionosphere Line of sight propagation.

***Suggested Reading:***

1. J. D. Kraus, R. J. Marhefka & Ahmad S. Khan, "Antennas and wave Propagation", McGraw-Hill, 4th Edition, 2010.
2. Constantine A. Balanis, "Antenna Theory: Analysis and Design", Wiley, 3rd edition, 2005
3. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems," 2/e, PHI, 2001
4. R.E.Collins, Antennas and Radio Propagation, Singapore: McGraw Hill, 1985.
5. R Harish and M. Sachidananda, Antennas and Wave Propagation, Oxford University Press, 2011.