

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course offers fundamental knowledge of wave guides and antenna propagation. The objective of this course is to make the student familiarize with parameters of antenna, different types of antennas and wave propagation.

Course Outcomes:

Upon successful completion of this course, students should be able to:

- CO1: Analyze the parallel plate waveguide and rectangular waveguides.
- CO2: Understand the fundamental characteristics of antennas (gain, bandwidth, directivity etc) in order to compute a wireless communication link.
- CO3: Distinguish the characteristics of antenna such as radiation pattern, radiation efficiency, radiation intensity, antenna temperature.
- CO4: Analyze different antenna arrays and patterns.
- CO5: Design the different antennas and properties.
- CO6: Discuss the mechanism of the atmospheric effects on radio wave propagation.

SKILLS:

- ✓ *Demonstrate the TE/ TM modes and identify the advantages of dominant mode.*
- ✓ *Identify the operating range of various standard wave guide sizes, and vice versa.*
- ✓ *Determine the dipole size for the given frequency range.*
- ✓ *Simulate multipath environment and measure the received signal strength.*
- ✓ *Draw the radiation patterns in various planes for uniform linear array (Broad side/endfire).*
- ✓ *Draw the radiation patterns of helical/ horn / aperture antennas.*
- ✓ *Determine the possible link distance for a given antenna height and vice versa.*



ACTIVITIES:

- Simulate different micro strip antennas for wireless applications like GPS/ Communication/ control.
- Simulate base station antennas 2G/ 3G/4G terminals.
- Design a Helical antenna / Microstrip antenna FOR Wireless Applications.
- Demonstrate multipath environment in urban locations.

UNIT - 1**L-9, T-5**

TRANSMISSION LINES AT HIGH FREQUENCIES: Parallel plate waveguides, Rectangular wave guides - Introduction, Application of Maxwell's equations to the rectangular waveguide, TE_{mn} & TM_{mn} modes in rectangular wave guides, Impossibility of TEM waves in wave guides, Attenuation of TE & TM modes, Characteristic impedance of waveguides.

UNIT - 2**L-9, T-3**

ANTENNA FUNDAMENTALS: Radiation mechanism, Monopole and dipoles, Current distribution on a thin wire antenna, Antenna parameters - Radiation patterns, Patterns in principal planes, Beam widths, Antenna temperature, Radiation intensity, Directivity, Gain, Reciprocity, Input impedance; Radiation resistance of dipole antenna, Relation between effective aperture and directivity, Effective height, Field regions, polarization, Friis transmission equation.

UNIT - 3**L-9, T-4**

ANTENNA ARRAYS: Analysis of uniformly spaced arrays with uniform amplitudes, Principle of multiplication of patterns, Effect of earth on vertical patterns, Patterns in other planes, Binomial array, Basic principle of Dolph- Tschebyscheff array.

UNIT - 4**L-9, T-2**

CHARACTERISTICS OF TYPICAL ANTENNAS: Rhombic antenna, Folded dipole, Loop antenna, Yagi-Uda array, Helical antenna, Corner reflector, Pyramidal Horn antenna, Parabolic reflector antennas, Slot antennas and micro strip antennas, Concept and benefits of smart antennas.

UNIT - 5**L-9, T-1**

RADIO WAVE PROPAGATION: Ground wave propagation, Earth constants, Space wave propagation, Fading, Effect of curvature of an ideal earth, Height gain factor, Atmospheric effects in space wave Propagation, Radio-Horizon, Duct propagation, Ionospheric propagation, Gyro frequency, Structure of the Ionosphere, Critical frequency, Skip distance, Maximum usable frequency.

TEXT BOOKS:

1. Constantain A Balanis, "Antenna Theory: Analysis and Design", 4th edition, Wiley Publishers, 2015.
2. Edward C Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition, PHI, 2003.

REFERENCE BOOKS:

1. J.D.Kraus and Ronald J Marhefka, "Antennas and Wave propagation", 4th edition, TMH, 2014.
2. K.D.Prasad and Satya Prakasan, "Antenna and Wave Propagation", Tech India Publications, 2001.
3. Constantain A Balanis, "Introduction to Smart antennas", 1st edition, Morgan and Claypool Publishers, 2007.
4. G.S.N.Raju, "Antennas and Wave Propagation", 1st edition, Pearson Publication, Singapore, 2005.
5. Samuel Y Liao, "Microwave Devices and Circuits", 3rd edition, Pearson Education, 2003.