EC-306 **ANTENNAS AND WAVE PROPAGATION** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To develop understanding of various types of antenna radiation mechanism.
2. To provide the knowledge of basic understanding of antenna operation through the application of Maxwell's equations.
3. To provide the basic knowledge to calculate array factor of array antennas.
4. To introduce the students various types of antennas and their performance Characteristics.
5. To develop the students' ability to apply modern mathematical techniques to the solutions of antenna problems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the radiation mechanism of EM waves by antennas and their radiation patterns.
2. analyze the power radiated by different antennas and their radiation characteristics.
3. interpret the relationships between antenna parameters.
4. design and analyze different antennas and antenna arrays.
5. understand the wave propagation mechanism at different frequencies.

UNIT I *Text Book - 1* **(10)**

RADIATION : Radiation Mechanism, Potential functions-heuristic approach, Maxwell's equation approach, Potential functions for sinusoidal oscillations.

Alternating current element, Power radiated by current element, Application to short antennas, Assumed current distribution, Radiation from quarter wave Monopole / half wave dipole.

UNIT II *Text Book - 2* **(10)**

ANTENNA FUNDAMENTALS : Isotropic, Directional, Omni-directional patterns, Principle patterns, Field regions, Radiation density, Radiation intensity, Directive gain, Power gain, Half power Beam width.

Antenna polarization, Power loss factor, Radiation efficiency, Effective aperture of antenna, Relation between maximum effective aperture and directivity, Friss transmission equation.

UNIT III *Text Book - 2* **(10)**

ARRAY ANTENNAS : Two element array, N-element uniform linear array, Side lobe level and beam width of broadside array, Beam width of end fire array, Principle of multiplication of patterns. Binomial array, Basic principle of Dolph-Tschebyscheff array. Circular array and phased array. Effect of earth on vertical patterns.

UNIT IV *Text Book - 1,3* **(13)**

CHARACTERISTICS OF TYPICAL ANTENNAS : Traveling wave antennas, V and Rhombic antennas, Folded Dipole, Loop antenna, Yagi Uda array, Helical antenna, Log periodic antenna, Pyramidal and conical Horn antenna.

Corner reflector antenna, Parabolic reflector antennas - Paraboloid and parabolic cylinder, Cassegrain system of reflectors, Lens Antenna, Basic principles of micro strip antennas.

UNIT V *Text Book - 1* **(12)**

RADIO WAVE PROPAGATION : Ground wave Propagation, Earth constants, Space-wave Propagation, Effect of curvature of an Ideal Earth, Variations of Field strength with height in space-wave Propagation, Atmospheric effects in space-wave Propagation, Radio-Horizon, Duct Propagation.

Tropospheric Scatter Propagation, Ionospheric Propagation, Gyro frequency, Refraction and reflection of Sky Waves by the Ionosphere, Critical Frequency, Skip Distance, Maximum Usable Frequency.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Edward C Jordan and Keith G Balmain - Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI, 2003.
2. Constantine A Balanis - Antenna Theory : Analysis and Design, Harper and Row Publishers, 2002.
3. G.S.N.Raju - Antennas and Wave Propagation, 1st Edition, Pearson Publication, Singapore.

REFERENCE BOOK(s):

1. J.D.Kraus and Ronald J Marhefka - Antennas For all Applications, TMH, 2003
2. F.E. Terman - Electronic and Radio Engineering, Mc Graw Hill, 1985.

WEB RESOURCES:

http://nptel.ac.in/courses/117107035/