Antennas and Wave Propagation

Course Code	23EC3503	Year	III	Semester	I
Course Category	PC	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Pre requisites	Electro Magnetic Fields & Waves
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		BL
CO1	Interpret the fundamental parameters of antennas and wave propagation in the construction of a wireless communication link	L2
CO2	Analyse various wire antennas, antenna arrays and establish their mathematical relations	L4
CO3	Develop antennas for different frequency ranges and analyse their radiation Properties.	L3
CO4	Analyse the wave propagation through different layers of atmosphere.	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of Correlations (3:High, 2:Medium, 1:Low)													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2							1	1		1	1	
CO2	3	3						2	2		2	2	
CO3	2							2	2		2	2	
CO4	3	1						1	2		1	1	
Avg.	3	2						2	2		2	2	

Syllabus		
Unit No.	Contents	Mapped CO
1	**Antenna Fundamentals:** Introduction, Types of Antennas, radiation mechanism – single wire, two- wire, dipoles, current distribution on a thin wire antenna, antenna parameters - radiation pattern, radiation power density, radiation intensity, beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, Polarization, input impedance antenna radiation efficiency, antenna vector effective length, equivalent areas and Friis transmission equation.	CO1, CO2
2	**Linear Wire Antennas:** Retarded potentials, radiation from small electric dipole, quarter wave monopole and half wave dipole – current distribution, evaluation of field components, power radiated, radiation resistance, Loop antennas-features. Helical antenna- axial mode and normal mode operations.	CO2, CO3
3	**Antenna Arrays:** Introduction, 2-element arrays – different cases, principle of pattern multiplication, N-element uniform linear arrays – broadside, end fire arrays, EFA with increased directivity, concept of scanning arrays, directivity relations, Binomial arrays.	CO2, CO3
4	**Broadband & Microwave Antennas**: **Broadband Antennas**: Introduction, folded dipole, Yagi-Uda antenna, reflector antennas- plane reflector, corner reflector, parabolic reflector,	CO2, CO3

	feed methods for parabolic reflectors, F/D ratio, aperture blocking. **Microstrip Antennas** –Introduction, Features, Advantages and Limitations, Rectangular Microstrip Antenna – Geometry, Feeding Methods, Characteristics of Microstrip Antennas. Circular Microstrip Antenna – Geometry& Design Parameters.	
5	**Wave Propagation**: Ground wave propagation–characteristics, parameters, wave tilt, flat and spherical earth considerations. Sky wave propagation – structural details of ionosphere, refraction and reflection, ray path, critical frequency, MUF, LUF, OF, skip distance, virtual height, Ionospheric abnormalities, Space wave propagation – mechanism, LOS and radio horizon. Tropospheric wave propagation – radius of curvature of path, effective earth's radius.	CO1,CO4

Learning Resources
Text Books
1. Constantine A. Balanis - Antenna Theory and Applications – John Wiley & Sons, 4th Ed., 2021. 2. John D Kraus, Ronald J Marhefka & Ahmad S Khan - Antennas and Wave Propagation TMH, 5th Ed., 2017..
Reference Books
1. E.C. Jordan and K.G. Balmain - Electromagnetic Waves and Radiating Systems – PHI, 2nd Ed., 2009. 2. K.D. Prasad, Satya Prakashan - Antennas and Wave Propagation – Tech India Publications, New Delhi, 2001..
e- Resources & other digital material
1. https://nptel.ac.in/courses/108101092 2. https://www.antenna-theory.com/antennas/dipole.php 3. https://www.antenna-theory.com/antennas/travelling/yagi.php 4. https://www.antenna-theory.com/basics/main.html