

19EC3501 - Antenna Analysis and Synthesis

Course Code	19EC3501	Year	III	Semester	I
Course Category	Program Core	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	EMW
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	
CO1	Interpret the fundamental parameters of antennas in order to construct a wireless communication link. L2
CO2	Analyse various wire antennas and establish their mathematical relations. L4
CO3	Develop antennas for different frequency ranges and analyse radiation properties L3
CO4	Construct and analyse antenna arrays and synthesize the arrays L4

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)														
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation														
* - Average value indicates course correlation strength with mapped PO														
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	2	2	1	1							1	2
CO2	3	3	3	2	2	2							2	3
CO3	3	3	3	2	2	2							2	3
CO4	2	3	3	3	2	2							2	3
Average* (Rounded to nearest integer)	3	3	3	2	2	2							2	3

Syllabus		
Unit No.	Contents	Mapped CO
I	Antenna Basics: Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna	CO1

	Theorems, Radiation, Retarded Potentials – Helmholtz Theorem	
II	Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).	CO1, CO2
III	VHF, UHF and Microwave Antennas - I: 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.	CO1, CO3
IV	VHF, UHF and Microwave Antennas - II: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern characteristics, Feed Methods, Reflector Types – Related Features.	CO1, CO3
V	Antenna Arrays: Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays. Antenna Synthesis: Introduction, Continuous Sources, Schelkunoff Polynomial Method and Fourier transform Method.	CO1, CO3 CO4

Learning Resources
Text Books
<ol style="list-style-type: none"> 1. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010. 2. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
Reference Books
<ol style="list-style-type: none"> 1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000. 2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001. 3. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007
e- Resources & other digital material
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/108/105/108105114/ 2. https://nptel.ac.in/courses/108/105/108105114/
