Programme	**M.Tech/Ph.D**	Year of Regulation	**2021-22**
Department	**Electronics and Communication Engineering**	Semester	**II**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 540	**Antenna Theory and Propagation**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	To study the fundamentals of antenna theory.	Course Outcomes	CO1	Ability to understand the fundamentals of antenna theory.
	To study basic antenna parameters and dipole radiation.		CO2	Ability to analyse the different antenna parameter and analysis of dipole radiation.
	To study the various antenna arrays.		CO3	Ability to analyse the various types of antenna array.
	To study the various types of antenna.		CO4	Ability to analyse the various types of antenna.
	To study the various kinds of propagation.		CO5	Ability to analyse the wave propagation.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	CO1	3	1	1	0	3	0	0	0	1	0	0	0	3	1	0	0
2	CO2	3	3	3	2	3	1	0	0	2	0	0	0	3	2	2	0
3	CO3	3	3	3	2	3	1	0	0	2	0	0	0	3	2	2	0
4	CO4	3	2	2	0	3	0	0	0	2	0	0	0	3	2	2	0
5	CO5	3	3	3	2	3	1	0	0	3	0	0	0	3	2	3	0

	SYLLABUS		
No.	**Content**	**Hours**	**COs**
I	Review of Maxwell's Equation; Condition of radiation of electromagnetic waves and introduction to Antenna; Vector Potential and Retarded Vector Potential; Radiation fields of a Hertzian dipole(electric); Duality Principle, Radiation fields due to short magnetic dipole.	8	CO1
II	Antenna Characteristics: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain, Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna. Radiation fields and Characteristics of $\lambda/2$ dipole; discussion on $\lambda/4$ monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length λ, $3\lambda/2$ and 2λ. Horizontal and Vertical antennas over a plane ground.	6	CO2
III	Antenna Arrays: electric Field due to 2 element arrays, 3 element Arrays; Pattern Multiplication; Uniform Linear Array: End fire and Broad side; Phased array.	6	CO3
IV	Compute the input and mutual impedance of the antennas, Characteristics and properties of :Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Loop Antenna, Electrically Short Antennas, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Design of Optimum Horn Antenna; Parabolic and Corner Reflectors and feed systems.	8	CO4
V	Methods of Propagation: Ground Wave Propagation, Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation, Ionospheric Layers, Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction. Friss Transmission Formula, SNR of a Radio Link. Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect.,to study impedance characteristics of antennas.	6	CO5
	Total Hours	34	

Essential Readings

1. Antenna (for all application), John D. Kraus and Ronald J. Marhcfka; Tata- MacGraw Hill,3rd Edition

2. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3rd Edition

Supplementary Readings

1. Modern Antenna Handbook; Constantine A. Balanis; Willey, 3rd Edition

2. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)

3. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2nd Edition (2009)