

COURSE CODE	COURSE TITLE	L	T	P	C
1151EC114	WAVEGUIDES AND ANTENNAS	2	2	0	3

a. Course Category:

Program Core

b. Preamble:

This course provides an introduction to the basic concepts of propagation of signals to transmission lines, radio Propagation in guided Systems and to learn its application. The quality of signals at receiver depends on type of transmitting and receiving antennas, their orientation, transmitting frequency and geographical terrain. For installation & maintenance of wireless systems, the basic knowledge of wave propagation theory is essential.

c. Prerequisite courses:

Electro Magnetic Fields

d. Related Courses:

Optical & Microwave Engineering, RF and Microwave Integrated Circuits

e. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain the propagation characteristics of electromagnetic waves in transmission lines	K2
	Solve the transmission line parameters using Smith chart.	K3
CO2	Describe the characteristics of guided waves between parallel planes, rectangular waveguide and circular waveguide.	K2
	Calculate the resonance frequency of cavity resonators and the associated modal field.	K3
CO3	Explain the general parameters to design an antenna. Explain the construction and operation of arrays, short dipole, loop antenna and slot antenna	K2
CO4	Apply the antenna characteristics to design various types of linear and planar antennas.	K3
CO5	Explain the knowledge of the structure of atmosphere, types of communication and propagation methods.	K2

f) Correlation of Co's with Po's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	L	L	-	L	-	L	L	-	M	L	-
CO2	H	M	L	M	-	-	-	-	-	-	-	L	-	-
CO3	L	L	H	H	H	-	H	L	L	L	L	H	M	-
CO4	L	L	H	H	H	-	H	L	-	L	-	H	M	-
CO5	L	L	-	-	-	L	M	-	-	-	-	L	-	-

g. Course Content :

UNIT I Transmission Line Theory 12

Transmission Line Theory: General theory of Transmission lines - the transmission line - general solution - Waveform distortion - the distortion less line - Loading and different methods of loading - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss. Line at High Frequencies: Standing waves and standing wave ratio on a line – One eighth wave line - The quarter wave line and half wave line. Single stub matching and double stub matching.

UNIT II Guided Waves 12

Waves between parallel planes: Transverse electric waves-Transverse magnetic wavesCharacteristic of TE and TM waves-TEM waves. TE waves and TM waves in Rectangular waveguides, TE waves and TM waves in circular waveguides and Microwave cavities.

UNIT III Antennas and Arrays 12

Introduction to Antenna basics and characteristics, Effective aperture, Friis Transmission formula, general concept of dipole antenna. Radiation resistance of a short dipole and loop antenna, Slot antennas, Babinet's principle. Arrays: Broadside array, end fire array and Pattern multiplication: Hansen and Woodyard array, Binomial arrays, Dolph-Chebychev arrays.

UNIT IV Special Antennas 12

Horn antenna, Helical antenna, Yagi-Uda antenna, Corner reflectors, Parabolic reflectors, Lens antenna, Omni directional antennas, MIMO antennas, antennas for satellite, antennas for ground penetrating radars, Ultra wide band antennas, plasma antenna.

UNIT V Propagation of Radio Waves 12

Modes of propagation, Structure of atmosphere, Ground wave propagation, Troposphere propagation, Duct propagation, Troposcatter propagation, Flat earth and Curved earth concept Sky wave propagation – Virtual height, critical frequency, Maximum usable frequency – Skip distance, Fading, Multi hop propagation.

Total 60Hrs

h. Learning Resources

Text Books

1. J.D.Ryder “Networks, Lines and Fields”, PHI, New Delhi, 2003.
2. John D Kraus,” Antennas for all Applications”, 3rd Edition, McGraw Hill, 2005.
3. E.C. Jordan and K.G.Balmain “Electro Magnetic Waves and Radiating System, PHI, New Delhi, 2003.
4. Warren L Stutzman and Gary A Thiele, —Antenna Theory and Design, 2ndEd, John Wiley and Sons Inc. 1998

References

1. Edward C.Jordan and Keith G.Balmain” Electromagnetic Waves and Radiating Systems” Prentice Hall of India, 2006
2. Ramo, Whineery and Van Duzer: “Fields and Waves in Communication Electronics” John Wiley, 2003.
3. Constantine.A.Balanis “Antenna Theory Analysis and Design”, Wiley Student Edition, 2006.
4. H.Sizun “Radio Wave Propagation for Telecommunication Applications”, First Indian Reprint, Springer Publications, 2007.

Online Resources

1. <http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Transmission%20Lines%20and%20EM%20Waves/TOC.htm>
2. <http://nptel.ac.in/courses/117101056/>
3. www.antenna-theory.com
4. <http://www.dxzone.com/catalog/Antennas>
5. http://www.engr.sjsu.edu/rkwok/EE172/Antenna_Fundamental.pdf