SARDAR RAJA COLLEGE OF ENGINEERING

ALANGULAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICRO LESSON PLAN

SUBJECT : ANTENNAS AND WAVE PROPAGATION

CODE : EC 2353

YEAR : III

SEM : VI

STAFF NAME : Mr. B.KARTHIK,

AP/ ECE.

EC2353 ANTENNAS AND WAVE PROPAGATION L T P C 3 1 0 4

AIM

To enable the student to study the various types of antennas and wave propagation.

OBJECTIVES

- To study radiation from a current element.
- To study antenna arrays
- To study aperture antennas
- To learn special antennas such as frequency independent and broad band antennas.
- To study radio wave propagation.

UNIT I: ELECTROMAGNETIC RADIATION AND ANTENNA FUNDAMENTALS 9

Review of electromagnetic theory: Vector potential, Solution of wave equation, Retarded case, Hertizian dipole. Antenna characteristics: Radiation pattern, Beam solid angle,Directivity, Gain, Input impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation patterns, Equivalence of Impedances, Effective aperture, Vector effective length, Antenna temperature.

UNIT II WIRE ANTENNAS AND ANTENNA ARRAYS
9

Wire antennas: Short dipole, Radiation resistance and Directivity, Half wave Dipole,Monopole, Small loop antennas. Antenna Arrays: Linear Array and Pattern Multiplication,Two-element Array, Uniform Array, Polynomial representation, Array with non-uniformExcitation-Binomial Array

UNIT III APERTURE ANTENNAS
9

Aperture Antennas: Magnetic Current and its fields, Uniqueness theorem, Field equivalence principle, Duality principle, Method of Images, Pattern properties, Slotantenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector,Corner Reflector, Common curved reflector shapes, Lens Antenna.

UNIT IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS
9

Special Antennas: Long wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna- Axial mode helix, Normal mode helix, Biconical Antenna, Log periodic Dipole Array, Spiral Antenna, Microstrip Patch Antennas. Antenna Measurements:

Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber measurement.

UNIT V RADIO WAVE PROPAGATION
9

Calculation of Great Circle Distance between any two points on earth, Ground WavePropagation, Free-space Propagation, Ground Reflection, Surface waves, Diffraction,

Wave propagation in complex Environments, Tropospheric Propagation, TroposphericScatter. Ionospheric propagation: Structure of ionosphere, Sky waves, skip distance,Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Effects ofearth's magnetic fields, Faraday rotation, Whistlers.

Tutorial = 15
Total =45 + 15 =60

TEXTBOOKS

1. E.C.Jordan and Balmain, "Electromagnetic waves and Radiating Systems",

Pearson Education / PHI, 2006

2. A.R.Harish, M.Sachidanada, "Antennas and Wave propagation", Oxford

University Press, 2007.

REFERENCES

1. John D.Kraus, Ronald J Marhefka and Ahmad S Khan, "Antennas for all

Applications", Tata McGraw-Hill Book Company, 3 ed, 2007.

2. G.S.N.Raju, Antenna Wave Propagation, Pearson Education, 2004.

3. Constantine A. Balanis, Antenna Theory Analysis and Desin, John Wiley, 2ndEdition, 2007.

4. R.E.Collins, "Antenna and Radiowave propagation",

5. W.L Stutzman and G.A. Thiele, "Antenna analysis and design", John Wiley, 2000.

SUBJECT DESCRIPTION AND OBJECTIVES

AIM

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DESCRIPTION

An **antenna** (or **aerial**) is an electrical device which converts electric power into radio waves, and vice versa. It is usually used with a radio transmitter or radio receiver. In transmission, a radio transmitter supplies an oscillating radio frequency electric current to the antenna's terminals, and the antenna radiates the energy from the current as electromagnetic waves (radio waves). In reception, an antenna intercepts some of the power of an electromagnetic wave in order to produce a tiny voltage at its terminals, that is applied to a receiver to be amplified.

Antennas are essential components of all equipment that uses radio. They are used in systems such as radio broadcasting, broadcast television, two-way radio, communications receivers, radar, cell phones, and satellite communications, as well as other devices such as garage door openers, wireless microphones, bluetooth enabled devices, wireless computer networks, baby monitors, and RFID tags on merchandise.

Typically an antenna consists of an arrangement of metallic conductors (elements), electrically connected (often through a transmission line) to the receiver or transmitter. An oscillating current of electrons forced through the antenna by a transmitter will create an oscillating magnetic field around the antenna elements, while the charge of the electrons also creates an oscillating electric field along the elements. These time-varying fields, when created in the proper proportions, radiate away from the antenna into space as a moving transverse electromagnetic field wave. Conversely, during reception, the oscillating electric and magnetic fields of an incoming radio wave exert force on the electrons in the antenna elements, causing them to move back and forth, creating oscillating currents in the antenna.

MICRO LESSON PLAN

Hours	LECTURE TOPICS	READING
UNIT I: ELECTROMAGNETIC RADIATION AND ANTENNA FUNDAMENTALS		
1	Review of electromagnetic theory: Vector potential, solution of wave equation	R1
2	Retarded case, Hertizian dipole	R1
3	Antenna parameters: Radiation pattern	R1
4	Beam solid angle, Directivity(AV Class)	T2
5	Gain, Input impedance	T2
6	Polarization, Bandwidth	R1
7,8	Reciprocity, Equivalence of Radiation patterns	R1
9,10	Equivalence of Impedances, Effective aperture	R1
11,12	Vector effective length, Antenna temperature	R1,T2
UNIT II WIRE ANTENNAS AND ANTENNA ARRAYS		
13	Wire antennas: Short dipole	T2
14	Radiation resistance and Directivity	R1
15	Half wave Dipole	T2
16	Monopole, Small loop antennas(AV Class)	T2,R1
17	Antenna Arrays: Linear Array	R1
18	Pattern Multiplication	R1
19	Two-element Array	R1
20,21	Uniform Array	R1
22,23	Polynomial representation	R1
24	Array with non-uniform Excitation	R1
25	Binomial Array	R1
UNIT III APERTURE ANTENNAS		

26	Aperture Antennas: Magnetic Current and its fields	R1
27	Uniqueness theorem	R1
28,29	Field equivalence principle	R1
30	Duality principle(AV Class)	R1
31,32	Method of Images, Pattern properties	R1
33	Slot antenna, Horn Antenna, Pyramidal Horn Antenna	R1
34,35	Reflector Antenna-Flat reflector,Corner Reflector	R1
36,37	Common curved reflector shapes, Lens Antenna.	R1
UNIT IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS		
38	Special Antennas: Long wire	R1
39	V and Rhombic Antenna(AV Class)	R1
40	Yagi-Uda Antenna, Turnstile Antenna	R1
41,42	Helical Antenna- Axial mode helix, Normal mode helix,	R1
43,44	Biconical Antenna, Log periodic Dipole Array	R1
45,46	Spiral Antenna, Microstrip Patch Antennas	R1
47,48	Antenna Measurements: Radiation Pattern measurement, Gain and Directivity Measurements	R1
49,50	Anechoic Chamber measurement	R1
UNIT V RADIO WAVE PROPAGATION		
51,52	Calculation of Great Circle Distance between any two points on earth	T2
53	Ground Wave Propagation, Free-space Propagation	R1
54,55	Ground Reflection, Surface waves, Diffraction	R1
56	Wave propagation in complex Environments, Tropospheric Propagation	R1
57,58	Troposphere Scatter. Ionospheric propagation: Structure of ionosphere	R1
59	Sky waves, skip distance, Virtual height	R1
60,61	Critical frequency, MUF, Electrical properties of ionosphere	R1
62	Effects of earth's magnetic fields	R1
63	Faraday rotation(AV Class)	R1

64	Whistlers	R1

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