



**CHRISTU JYOTI INSTITUTE OF TECHNOLOGY & SCIENCE**

**(Approved by AICTE, New Delhi & Affiliated to JNTU Hyderabad)**

Colombo Nagar, Yeshwanthapur, Jangaon, 506 167-TS

**Department of Electronics & Communication Engineering**

## **Antennas & Propagation Lesson Plan**

<b>Program Name</b>	B.Tech in ECE	<b>AY</b>	2022-23
<b>Course Name</b>	Antennas & Propagation	<b>Class / Sem</b>	III-II
<b>Faculty Name</b>	Allanki Sanyasi Rao	<b>Regulation</b>	R18

<b>Lecture No.</b>	<b>Topic</b>	<b>Teaching Aids</b>	<b>Reference(s)</b>
1	<b>UNIT – I</b> Introduction – Importance of the Subject, Definition of Antenna	TM1	T1
2	Radiation Mechanism in Single wire, two wire and in dipole, Field Zones	TM1, TM2, TM6	T1, T2, R1
3	Dual Characteristics of an Antenna, Isotropic Radiator, Basic Antenna Parameters: Radiation Pattern, Front to Back Ratio, Power Radiation Pattern, Radiation Intensity, Beam Width, Beam Area	TM1, TM2	T1, T2, R1, R2
4	Beam Efficiency , Antenna Gain – Directive gain and power gain and relation between them, Antenna Efficiency	TM1, TM2, TM6	T1, R2
5	Directivity, Resolution , Antenna Aperture	TM1, TM2	T1, R2
6	Effective aperture of a dipole, Effective Height, Relation between Directivity, Effective Aperture and Gain	TM1, TM2	T1, R1, R2
7	Antenna Temperature, Frii's Transmission formula Problems	TM1, TM2	T1
8	Fields from an Oscillating Dipole, Antenna theorems	TM1, TM2	T1, T2, R2
9	Retarded potentials - Helmholtz Theorem	TM1, TM2, TM6	T1, T2, R1
10	Radiation from Small Electric Dipole (or) Hertzian Dipole	TM1, TM2	T1, T2, R1, R2
11	Power radiated by a current element	TM1, TM2, TM6	T1, T2, R1
12	Effective aperture, Directivity, Effective length of a current element	TM1, TM2	T1, R1, R2
13	Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Power radiations and Radiation resistance of short dipole antenna, for mono pole and half wave dipole	TM1, TM2	T1
14	Power radiated by Vertically earthed antenna	TM1, TM2	T1
15	Field strength in terms of power relative to Isotropic antenna – Half wave and mono pole	TM1, TM2	T1, T2, R2
16	Average power in terms of effective or rms currents	TM1, TM2	T1, R2

17	Natural Current Distributions	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub>
18	Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>2</sub>
19	Loop Antennas – Small Loop, Radiation Resistances and Directivities of Small Loops	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , T <sub>2</sub> , R <sub>1</sub> , R <sub>2</sub>
20	Comparison of Far Fields of small Loop and Short dipole	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub>
21	<b>UNIT – II</b> Introduction to Antenna Arrays, Array of Point sources	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub> , R <sub>2</sub>
22	Two sources with currents equal in magnitude and phase	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>2</sub>
23	Two sources with currents equal in magnitude but opposite in phase,	TM <sub>1</sub> , TM <sub>2</sub> , TM <sub>3</sub>	T <sub>1</sub> , R <sub>2</sub>
24	Two point sources with currents unequal in magnitude and with any phase, n Element uniform linear arrays	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>2</sub>
25, 26	Array of n elements with equal spacing and currents equal in magnitude and phase- Broad side array	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>2</sub>
27, 28	Array of n elements with equal spacing and currents equal in magnitude but with progressive phase shift – End fire array	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub>
29	Array of n elements with equal spacing and currents with equal amplitude and progressive phase shift – End fire array with increased Directivity.	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub>
30	Principle of Pattern Multiplication	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub>
31	BSAs with Non-Uniform Amplitude Distributions – General Considerations, Binomial Arrays	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>2</sub>
32	Problems	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , T <sub>2</sub> , R <sub>1</sub> , R <sub>2</sub>
33	Antenna measurements, Concept, Reciprocity theorem, Near and far fields, Coordinate systems for antenna measurement	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub>
34	Sources of Errors	TM <sub>1</sub> , TM <sub>2</sub> , TM <sub>3</sub>	T <sub>1</sub> , R <sub>1</sub>
35	Pattern measurement, Set up for measurement of radiation pattern	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub>
36	Directivity measurement	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub> , R <sub>2</sub>
37	Gain measurement	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub> , R <sub>2</sub>
38	<b>UNIT – III: VHF, UHF and Microwave Antennas-I</b> Arrays with parasitic elements	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub> , R <sub>2</sub>
39	Yagi-Uda Antenna	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , T <sub>2</sub> , R <sub>1</sub> , R <sub>2</sub>
40	Folded dipole Antenna	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub>
41	Helical antennas – Significance & Geometry	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub>
42	Basic properties of Helical antennas, Design considerations for monofilar helical antennas in axial mode and normal modes	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub> , R <sub>2</sub>
43	Horn antennas – types, Fermat's principle	TM <sub>1</sub> , TM <sub>2</sub> , TM <sub>3</sub>	T <sub>1</sub> , T <sub>2</sub> , R <sub>1</sub> , R <sub>2</sub>
44	Optimum Horns, Design considerations of pyramidal horns	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , T <sub>2</sub> , R <sub>1</sub> , R <sub>2</sub>
45	Problems	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , T <sub>2</sub>
46	<b>UNIT – IV</b> Micro strip antennas – introduction, Features, Advantages & limitation of Microstrip Antenna	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , T <sub>2</sub> , R <sub>1</sub> , R <sub>2</sub>
47	Rectangular patch antennas-geometry, Parameters	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub>
48	Characteristics of Microstrip antennas	TM <sub>1</sub> , TM <sub>2</sub>	T <sub>1</sub> , R <sub>1</sub>

49	Reflector antennas, Flat sheet reflector, Corner Reflector	TM1, TM2	T1, R1, R2
50	Paraboloidal Reflectors – Principle, Geometry	TM1, TM2	T1, R1, R2
51	Pattern Characteristics	TM1, TM2	T1, R1, R2
52	Feed Methods	TM1, TM2, TM3	T1, R1, R2
53	Reflector Types	TM1, TM2	T1, R1, R2
54	Problems	TM1, TM2	T1, R2
55	<b>UNIT – V</b> Introduction – categorization and general, classifications	TM1, TM2	T2, R2
56	Modes of Wave propagation, Ray/Mode concepts	TM1, TM2, TM6	T2, R2
57	<b>Ground wave propagation</b> - plane earth reflection	TM1, TM2	T2, R2
58	Space and surface waves, wave tilt, Curved earth reflections	TM1, TM2	T2, R2
59	<b>Space wave propagation</b> - Introduction, Field strength variation with distance and height	TM1, TM2	T2, R2
60	Effect of earth's curvature, Absorption, Super reflection	TM1, TM2, TM22	T2, R2
61	M-Curves & Duct propagation	TM1, TM2	T2, R2
62	Scattering phenomenon, Troposphere propagation	TM1, TM2, TM6	T2, R2
63	Fading, Path calculations	TM1, TM2, TM3	T2, R2
64	<b>Sky wave propagation</b> - introduction, Structure of Ionosphere	TM1, TM2, TM6	T2, R2
65	Refraction & Reflection of sky waves by Ionosphere	TM1, TM2	T2, R2
66	Ray path, Critical frequency, MUF, LUF, OF	TM1, TM2	T2, R2
67	Virtual height, Skip distance	TM1, TM2, TM22	T2, R2
68	Relation between MUF and Skip distance	TM1, TM2	T2, R2
69	Multi hop propagation	TM1, TM2, TM3	T2, R2
<b>Gaps</b>			
70	Antenna Temperature	TM1, TM2	T1, T2, R2
71	Collinear Array	TM1, TM2	T1
72	Polarization Measurement	TM1, TM2	T1, T2
<b>Beyond Syllabus</b>			
73	Log Periodic Antennas	TM1, TM2	T1, T2, R1
74	Corrugated Horns	TM1, TM2, TM6	T1, T2, R1
75	Antenna Design Considerations for Satellite Communication	TM2, TM3, TM4	TM2, R1

TM1: Chalk and talk	TM2: PPT	TM3: Seminar/Guest Lecture	TM4: Webinar
TM5: Lab Demos	TM6: Audio Visual Aids	TM7: Group Discussion	TM8: Field Visits
TM9: 3D models	TM10: Puzzle	TM11: Quiz	TM12: Industrial Visits
TM13: Case Study	TM14: Flash Cards	TM15: Text Book Assignment	TM16: Role Play
TM17: Surveys	TM18: Open Text Book Test	TM19: Cross Word Puzzles	TM20: Debates
TM21: Individual Projects	TM22: Think Share		

**TEXT BOOKS:**

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. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

**REFERENCE BOOKS:**

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Radio Engineering Handbook- Keith henney, 3rd edition TMH.
4. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007

**WEBSITES:**

W1: <https://www.youtube.com/playlist?list=PLJCwoCleZAteziWqWoXeyM2g4XPQ3Dv41>

W2: [https://www.youtube.com/watch?v=wx\\_tlvaaajAI&list=PL3UZlxOnyu9CRoBFsG5x-VqYeC69FmMZT](https://www.youtube.com/watch?v=wx_tlvaaajAI&list=PL3UZlxOnyu9CRoBFsG5x-VqYeC69FmMZT)

W3: <https://www.youtube.com/playlist?list=PLIzcioi3jRIR8f6wtY5StBS5fkg4gZPwj>

W4: <https://www.youtube.com/playlist?list=PLgwJf8NK-2e7tzLIDL4aXUbtRFY3ykmkT>

W5: <https://www.youtube.com/playlist?list=PLXnsjPD8-xutkakRbo6YTX1ZmS5wVsevh>

W6: [https://www.youtube.com/playlist?list=PLMpCSwrw7iRG\\_UJgF7aUV4QhHwToTVDRi](https://www.youtube.com/playlist?list=PLMpCSwrw7iRG_UJgF7aUV4QhHwToTVDRi)

W7: [https://www.tutorialspoint.com/antenna\\_theory](https://www.tutorialspoint.com/antenna_theory)

W8: <https://antenna-radiation-diagram-plotter.soft112.com/>

W9: <https://demonstrations.wolfram.com/DipoleAntennaRadiationPattern/>

W10: <https://demonstrations.wolfram.com/DirectivityPatternOfLineArrays/>