Lok Jagruti Kendra University
University with a Difference

Diploma in Electronics & Communication Engineering

LJ Polytechnic

Course Code: 025030303 Antenna and Wave Propagation

Programme / Branch Name	Diploma in Electronics and Communication Engineering					
Course Code	Antenna and Wave Propagation				**Course Code**	025030303
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**Total Marks**
3	0	2	4	50	50	50	150

Legends: L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisite

- ✓ Physics and Mathematics (Pre-university level)
- ✓ Measure basic electrical and electronic quantities/parameters
- ✓ Use major electrical/electronic machines//instrument/equipment

3. Rationale

This course handles the basics of antennas and wave propagation. There are lots of different types of antennas. Trying to learn about all details about different sorts of antennas. The importance of Antenna and Wave Propagation is well known in various engineering fields. It provides logical of explaining various complicated concepts and stepwise methods. Each unit is well supported with necessary illustrations, practical examples and solved problems. All units in this book are arranged in a proper sequence that permits each topic to build upon earlier studies.

4. Objectives

- ✓ Understand basic terminology and concepts of Antennas.
- ✓ To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
- ✓ Analyze the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
- ✓ To have knowledge on antenna operation and types as well as their usage in real time filed.
- ✓ Aware of the wave spectrum and respective band-based antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcome	% Weightage	Hours
1	**Antenna Basics**	1.1. Introduction 1.2. Basic Antenna Parameters 1.3. Radiation Pattern 1.4. Beam Area 1.5. Radiated Power 1.6. Radiation Resistance 1.7. Radiation Intensity 1.8. Beam Efficiency 1.9. Directivity and Resolution 1.10. Antenna Apertures 1.11. Effective Height 1.12. Linear, Elliptical and Circular Polarization 1.13. Antenna Impedance 1.14. Front-to-back Ratio 1.15. HPBW 1.16. Electric field intensity 1.17. Effect of Ground on Antenna	• Electromagnetic field radiation of antenna • Basic function of antenna • Application of antenna • Frequency range • Terminologies of antenna	15	8
2	**VHF, UHF and Microwave Antennas**	2.1 Halfwave Diploe 2.2 Folded Dipoles 2.3 Helical Antennas 2.4 Parabolic Antennas 2.5 Loop Antennas 2.6 Slots Antennas	• Radiation pattern and working of different VHF, UHF and microwave antenna	25	8
3	**Antenna Arrays**	3.1 Yagi-Uda Array 3.2 Design parameters of Yagi-Uda Array 3.3 Broadside Arrays 3.4 Endfire Arrays 3.5 Turnstile & Super Turnstile Antenna 3.6 Horn Antennas 3.7 Microstrip Antennas	• Antenna vs Array • Different types of array antenna • Special purpose antenna	15	8
4	**Basic of Wave Propagation**	4.1 Definition and Broad Categorization 4.2 Guided Waves 4.3 Unguided Waves 4.4 Classification of Electromagnetic Waves 4.5 Ground Wave Propagation 4.6 Effects of Curvature of Earth 4.7 Duct Propagation	• Fundamentals of propagation • Types of propagation • Types of waves • Ground wave propagation and its types	25	10

5	**Sky Wave Propagation**	5.1 Space wave Propagation 5.2 Characteristics of Different Layers 5.3 Critical Frequency 5.4 Virtual Height 5.5 Maximum Usable Frequency 5.6 Service Range and Skip Distance 5.7 Ionosphere Fading	• Ionosphere layers • Sky wave propagation • Terminology of sky wave propagation • Skip distance • Fading effect	20	9
				Total Hours	**43**

6. List of Practicals / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practical / Exercises	Key Competency	Hours
1	To write a program to plot the radiation pattern of Dipole Antenna using MATLAB.	MATLAB, Antenna Parameters	2
2	To write a program to plot radiation pattern of Monopole antenna using MATLAB.	MATLAB, Antenna Parameters	2
3	To write a program to plot radiation pattern of Loop antenna using MATLAB.	MATLAB, Antenna Parameters	2
4	To write a Program to plot radiation pattern of Linear array antenna using MATLAB.	MATLAB, Antenna Parameters	2
5	To write a Program to plot radiation pattern of Circular array antenna using MATLAB.	MATLAB, Antenna Parameters	2
6	To write a Program to plot radiation pattern of Broadside array antenna using MATLAB.	MATLAB, Antenna Parameters	2
7	To write a Program to plot radiation pattern of End-fire array antenna using MATLAB.	MATLAB, Antenna Parameters	2
8	To write a program to plot radiation pattern of travelling wave antenna using MATLAB.	MATLAB, Antenna Parameters	2
9	To write a program to determine the directivity, the beam solid angle and the maximum directivity of an antenna using MATLAB.	MATLAB, Antenna Parameters	2
10	To write a program to plot 3-D pattern of Rectangular Apertures using MATLAB.	MATLAB, Antenna Parameters	2
11	To write a program to plot 3-D pattern of Circular Aperture using MATLAB.	MATLAB, Antenna Parameters	2
12	To write a program to plot 3-D Radiation Pattern of Dipole Antenna using MATLAB.	MATLAB, Antenna Parameters	2
13	To write a program to plot 3D radiation pattern for End fire antenna array using MATLAB.	MATLAB, Antenna Parameters	2
14	To write a program to design Microstrip antenna using MATLAB.	MATLAB, Antenna Parameters	2
15	To design Yagi-Uda antenna for specific frequency and calculate total length of antenna.	MATLAB, Antenna Parameters	2

Total Hours 30

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Antenna Basics	8	40	20	20	0	10	10
2	VHF, UHF and Microwave Antennas	8	20	20	10	20	20	10
3	Antenna Arrays	8	20	20	15	15	15	15
4	Basic of Wave Propagation	10	20	20	15	20	10	15
5	Sky Wave Propagation	9	20	20	20	10	20	10

Legends: R-Remembering C- Creating
U- Understanding E- Evaluating
App- Applying An- Analyzing

8. Textbooks

1) Antenna and Wave Propagation by J D Kraus, TMG Publication

9. Reference Books

1) Antenna and Wave Propagation by G S N Raju,
2) Fundamentals of Antennas, Arrays, and Mobile Communications by John Volakis, Pearson Publication
3) Antenna and Wave Propagation by A K Gautam, Katson Publication
4) Electronic Communication by George Kenedy, TMG Publication

10. Open Sources (Website, Video, Movie)

1) www.cst.com
2) http://www.antennamagus.com/
3) http://www.antennamagus.com/antennas.php?page=antennas
4) http://emcos.com/Antenna-Simulation-and-Optimization
5) http://www.apparentlyapparel.com/uploads/5/3/5/6/5356442/practical_antenna_handbook_fourth_edition_carr.pdf