Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Electronics and communication Engineering

(Academic year: 2019-2020)

Subject Code: EC 602-N	**Subject Title: Antenna and Wave Propagation**.
Pre-requisite	

Course Objective:

The educational objectives of this course are

- To present a problem oriented introductory knowledge of Antenna and Wave Propagation.
- To address the underlying concepts and methods behind Antenna and Wave Propagation.

Teaching Scheme (Credits and Hours)

Teaching scheme				**Total Credit**	**Evaluation Scheme**					**Total Marks**
L	**T**	**P**	**Total**		**Theory**		**IE Marks**	**CIA Marks**	**Pract. Marks**	
Hrs	**Hrs**	**Hrs**	**Hrs**		**Hrs**	**Marks**				
03	00	02	05	04	03	70	30	20	30	150

Outline of the Course:

Sr. No.	**Title of the Unit**	**Minimum Hours**
1.	Basic antenna concepts	02
2.	Radiation of Electric dipole	07
3.	Antenna parameters and definitions	07
4.	Arrays of point sources	07
5.	Loop Antenna	03
6.	Helical antenna	03
7.	Arrays of dipoles & apertures	03
8.	Reflector antennas	02
9.	Slot patch & Horn antennas	02
10.	Microstrip (patch) antennas	02
11.	Lens antennas	02
12.	Broadband & Freq. Independent antennas	02
13.	Antennas for special applications	02
14.	Antennas measurements	02
15.	Radio wave propagation	02
		48

Total hours (Theory): 48
Total hours (Lab): 32
Total hours: 80

Detailed Syllabus:

Unit No.	Topics	Lecture Hours	Weightage(%)
1.	**Basic antenna concepts**: Definition and functions of an antenna, comparison between an antenna & transmission line, radio communication link with transmitting antenna and a receiving antenna, radiation patterns of antennas-field and power patterns, all antenna types.	02	**04**
2.	**Radiation of Electric dipole:** Potential functions and the electromagnetic field, Oscillating electric dipole derivations for E and H field components in spherical coordinate systems, Power Radiated by a current element, Application to antennas, Radiation from quarter wave monopole and half wave dipoles, Derivation for radiation resistance, application of reciprocity theorem to antennas, equality of directional patterns and effective lengths of transmitting and receiving antennas, directional properties of dipole antennas, antenna feeding methods.	07	**15**
3.	**Antenna parameters and definitions:** beam area, beam width- Half-Power Beam width (HPBW) and First Null Beam width (FNBW), Polarization, Radiation Intensity, Beam Efficiency, Directivity and directive gain, radiation resistance, radiation efficiency, resolution, Antenna aperture-physical and effective apertures, effective height, transmission formula, antenna field zones, Transmission loss as a function of frequency. Antenna temperature and signal to noise ratio.	07	**15**
4.	**Arrays of point sources :** Expression for electric fields from two, three and N element arrays- linear arrays: Broad-side array and End-Fire array- Method of pattern multiplication- Binomial array-Horizontal and Vertical Antennas above the ground plane, Effect of ground on ungrounded antenna, Schelkunoff theorems for linear arrays, Dolph-Tchebysheff distribution for linear arrays.	07	**15**
5.	**Loop Antenna:** Small loop short magnetic dipole, comparison of far field of small loop and short dipole loop antennas, field pattern of circular loop antenna & radiation resistance of loop antenna, directivity of circular loop antennas with uniform current.	03	**7**
6.	**Helical antenna:** Helical geometry, transmission radiation modes, practical design considerations, wide band characteristics of helical antenna.	03	**6**
7.	**Arrays of dipoles & apertures**: 3 element dipole Array with parasitic elements, Yagi-uda array-function and its design, Phased arrays, frequency scanning arrays, smart antennas, long wire antennas, location methods of feeding antennas, folded dipole antennas, matching arrangements.	03	**6**

8.	**Reflector antennas**: Parabolic reflector, paraboloid reflector, aperture Pattern of large circular apertures with uniform illumination, off axis operation of paraboloid reflectors, Cassegrain feed system.	02	**6**
9.	**Slot patch & Horn antennas**: Slot antenna, its pattern, Babinet's principle and complementary antennas, impedance of slot antennas, and horn antenna-function and types.	02	**6**
10.	**Microstrip (patch) antennas :** Rectangular and circular types-function, features analysis ,design considerations and applications	02	**4**
11.	**Lens antennas**: Nonmetallic Dielectric lens and artificial dielectric lens antennas, reflector lens antennas.	02	**4**
12.	**Broadband & Freq. Independent antennas**: Broadband antenna, Frequency. Independent antenna, log periodic antennas.	02	**4**
13.	**Antennas for special applications:** Antennas design consideration for satellite communication, antenna for terrestrial mobile communication systems, GPR, Embedded antennas, UWB, Plasma antenna.	02	**3**
14.	**Antennas measurements**: Experimental set ups for Measurement of radiation patterns, gain, phase polarization, terminal impedance.	02	**3**
15.	**Radio wave propagation** : Modes of propagation, Ground Wave Propagation, Structure of troposphere and ionosphere, Characteristic of Ionospheric layers, Sky wave propagation, definitions for Virtual height, MUF and Skip distance, OWF, Fading, ionospheric absorptions, Multi-hop propagation, Space wave propagation and Super refraction.	02	**3**
	Total	48	**100**

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

The educational objectives of this course are

- To present a problem oriented introductory knowledge of Antenna and Wave Propagation.
- To address the underlying concepts and methods behind Antenna and Wave Propagation on successful completion of the course. The student can identify different areas of Antenna and Wave Propagation circuits.
- Can find the applications of all the areas in day to day life.
- Can identify the operations, working, construction, material etc. aspects of different types of antennas such as slot antenna, horn antenna, dipole antenna, yagi-uda antenna, reflector antenna, microstrip antenna, UWB antenna, Embedded antenna etc.

TEXT & REFERENCE BOOKS:

1. Antennas for all applications 3 edition. by J.D.Krauss, TMH.
2. Electromagnetic wave & radiating systems by Jordan & Balmain, PHI Publication.
3. Antenna & Wave Propagation by K.D. Prasad, Satyaprakash Publications.
4. Antenna Theory: Analysis and design –C. Balanis ,Wiley India.
5. Antenna and wave propagation By G.S.N. Raju,Pearson Education

List of experiments (Not limited to following. Subject teacher may modify the same)**:**

Sr. No.	Experiment Title
1.	Arranging the Antenna trainer and performing functional checks.
2.	To study simple λ/2 dipole antenna.
3.	To perform polarization test.
4.	To perform Modulation test.
5.	To study the variation in the radiation strength at a given distance from the antenna
6.	To study the Reciprocity theorem for antennas.
7.	To study simple λ/4 dipole antenna.
8.	To study folded dipole λ/2 antenna.
9.	To study Yagi-Uda antenna.
10.	To study Hertz antenna.
11.	To study Log Periodic antenna.
12.	To study cut paraboloid reflector antenna.
13.	To study loop antenna.
14.	To study Rhombus antenna.
15.	To study Ground plane antenna.
16.	To study Slot antenna.
17.	To study Helix antenna.
18.	To study the antenna bandwidth.
19.	To study different types of antenna characteristics using simulation software.