

| <b>Devi Ahilya University, Indore, India<br/>Institute of Engineering &amp; Technology</b> |  |          |          | <b>IV Year B.E. (Electronics and<br/>Telecommunication Engg.)</b> |          |          |              |
|--|--|----------|----------|---|----------|----------|--------------|
| <b>Subject Code &amp; Name</b>   | <b>Instructions Hours per<br/>Week</b>       |          |          | <b>Credits</b>  |          |          |              |
| <b>7ETRC4<br/>ANTENNA AND<br/>WAVE<br/>PROPOGATION</b>                                     | <b>L</b>                                     | <b>T</b> | <b>P</b> | <b>L</b>  | <b>T</b> | <b>P</b> | <b>Total</b> |
|  | <b>Duration of Theory<br/>Paper: 3 Hours</b> | <b>3</b> | <b>1</b> | <b>2</b>  | <b>3</b> | <b>1</b> | <b>1</b>     |

### **Course Learning Objective:**

- The fundamental concepts of antenna and radiation mechanism has been dealt
- It gives emphasis that how electric dipole antenna is dealt
- The concept of antenna arrays has been explained
- Development of Yagi Uda antenna and practical antennas have been dealt
- Discussion on the radio wave propagation and sky wave propagation

### **COURSE CONTENTS**

#### **UNIT-I Antenna Fundamentals:**

Introduction to types of antennas, radiation mechanism, current distribution on thin wire antenna, radiation pattern like isotropic, directional and omnidirectional, Radiation intensity, gain, directive gain, directivity, antenna efficiency, effective area, effective length, reciprocity theorem, radar equation, beam efficiency, bandwidth, polarization Antenna temperatures, FBR, radiation resistance, Equivalent noise temperature of antenna.

#### **UNIT-II Radiation from Wires and Loops:**

Poynting theorem, wave equation in terms of electromagnetic potentials and their solution, short electric dipole, retarded vector potential, small current element, small dipole, Finite length dipole, Half wavelength dipole, Infinite perfect conductors, ground effects.

#### **UNIT-III Antenna Arrays:**

Introduction to various form of array, array of n isotropic sources of equal and unequal amplitude and uniform spacing, design consideration of Broadside, End fire, Dolphy Tchebyscheff arrays, continuous arrays, rectangular arrays, planar array, binomial array circular array, and super directivity.

#### **UNIT-IV Broadband Antennas:**

Huygens' Principle, Hertz and Marconi antenna, ground and antenna losses, High frequency antenna, Dipole antenna, Harmonic antenna and inverted V antenna, Rhombic Antenna, RDF, Loop antenna, Adcock Antennas & direction finder, Folded Antenna, Yagi Uda

Antenna, Corner Reflected Antenna, Helical Antenna, Horn Antenna, Slot Antenna, Microstrip Antenna, LPDA, Microwave Antenna, Antenna with parabolic reflector, Lens Antenna, Babinet's Principle, Antenna Measurements.

**UNIT-V Wave Propagation :-**

Modes of propagation, Sky wave propagation, Effect of earth's magnetic field on Ionospheric radio wave propagation, Virtual heights, MUF, LUF, Skip distance, OMF, Ionospheric abnormalities, Multihop propagation, Duct propagation, VLF and ELF propagations.

**Course Outcomes:**

Upon completing the course, student will able to grasp the fundamental concept of antenna and its radiation mechanism

| CO. No | CO   | PO         |
|--------|--|------------|
| CO1    | The fundamental concepts of antenna and radiation mechanism has been dealt | PO-1, PO-2 |
| CO2    | It gives emphasis that how electric dipole antenna is dealt                | PO-2,PO-3  |
| CO3    | The concept of antenna arrays has been explained                           | PO-4       |
| CO4    | Development of Yagi Uda antenna and practical antennas have been dealt     | PO-5       |
| CO5    | Discussion on the radio wave propagation and sky wave propagation          | PO10       |

**CO-PO Relationship**

| CO  | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 |
|-----|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| CO1 | 2    | 2    |      |      |      |      |      |      |      |       |       |       |
| CO2 |      | 3    | 3    |      |      |      |      |      |      |       |       |       |
| CO3 |      |      |      | 3    |      |      |      |      |      |       |       |       |
| CO4 |      |      |      |      | 2    |      |      |      |      |       |       |       |
| CO5 |      |      |      |      |      |      |      |      |      | 3     |       |       |

**BOOKS RECOMMENDED:**

- [1]. K.D.Prasad, Antenna and Wave Propagation, 3/e, Satya Prakashan, New Delhi; reprint-2007.
- [2]. Constantine A.Balanis, Antenna Theory: Analysis and Design, 2/e, John Wiley & Sons Inc, Noida India.
- [3]. John Daniel Kraus, Ronald J. Marhefka, Antennas, 3/e, McGraw-Hill Higher Education
- [4]. C.G.Christodoulou, P.F.Wahid, Fundamentals of Antennas: Concepts and Applications, SPIE
- [5]. S.R.Saunders, Antennas and Propagation for Wireless Communication Systems, 1/e, Wiley, John & Sons, Inc.
- [6]. Richard C. Johnson, Henry Jasik, Antenna Engineering Handbook, McGraw-Hill Companies.

### **List of Practical Experiments:**

- 1) Arranging the trainer and performing checks.
- 2) Study of simple dipole antenna
- 3) Study of the variation in signal strength at given distance from the antenna.
- 4) Study of Reciprocity theorem.
- 5) Study of Yagi Uda 3 element folded dipole.
- 6) ) Study of Yagi Uda 5 element folded dipole.
- 7) Study of  $\lambda/2$  phased array end fire antenna..
- 8) Study of  $\lambda/4$  phased array antenna.
- 20) Study of Broadside array
- 21) Study of Log Periodic antenna.