

## **Antenna Theory & Propagation**

**EC-604A**

**Contracts: 3L**

**Credits- 3**

### **Module-I [7]**

A. Review of Maxwell's Equation; Radiation of e.m waves and introducing Antenna; Vector Potential and Retarded Vector Potential; Radiation fields of a Hertzian dipole(electric); Duality Principle, Radiation fields due to short magnetic dipole.

B. Antenna Characteristics: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain; Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna.

### **Module-II [9]**

A. Radiation fields and Characteristics of  $\lambda/2$  dipole; discussion on  $\lambda/4$  monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length  $\lambda$ ,  $3\lambda/2$  and  $2\lambda$ . Horizontal and Vertical antennas over a plane ground.

B. Antenna Arrays: electric Field due to 2 element arrays, 3 element Arrays; Pattern Multiplication; Uniform Linear Array: End fire and Broad side; Phased array.

### **Module-III [10]**

A. Characteristics and properties of :Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Loop Antenna, Electrically Short Antennas, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna.

B. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Design of Optimum Horn Antenna; Parabolic and Corner Reflectors and feed systems.  
[Major stress on Characteristics features, applications (including frequency at which used), advantages and disadvantages, major design principles and equations (without long and detailed derivations)]

### **Module-IV [10]**

A. Methods of Propagation: Ground Wave Propagation, Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction.

B. Friis Transmission Formula, SNR of a Radio Link. Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect.

### **Recommended (Text Books)**

1. Antenna (for all application), John D. Kraus and Ronald J. Marhcfska; Tata- MacGraw Hill, 3rd Edition
2. Antenna & Wave Propagation, K.D Prasad; Satya Prakashan, New Delhi, 3rd Edition
3. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3rd Edition

### **Reference Book**

1. Elements of Electromagnetics; Mathew N.O. Sadiku, Oxford University Press, 5th Edition(2010)
2. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2nd Edition (2009)
3. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)