ANTENNA AND WAVE PROPAGATION

Paper Code **ECS-603**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT-I ELECTROMAGNETIC WAVES

Review of Maxwell's equations and boundary conditions. Wave equations and their solutions. Uniform plane waves, sinusoidal time variation, wave-propagation in lossless and conducting media, propagation in good dielectrics and conductors, depth of penetration, polarization, reflection and reflection co-efficient, reflection and refraction of planes waves by conductors and dielectrics, surface impedance.

UNIT-II GUIDED WAVES AND WAVEGUIDES

Guided wave propagation between parallel conducting planes, TE, TM and TEM modes of propagation, velocity of propagation, attenuation in parallel plane guides, rectangular plane guides: TE, TM and TEM modes of propagation, excitation of modes in waveguides. Introduction to cavity resonator. Introduction to cylindrical (metallic and dielectric) waveguides.

UNIT-III ANTENNA THEORY

Vector magnetic potential and retarded potentials. The alternating current element and its induction and radiation fields, power radiated by a current element, application to short and long antennae. Radiation resistance, directional properties of antennae, radiation patterns, Reciprocity theorem, equivalence of the receiving and transmitting patterns of an antenna. Directivity and gain, receiving cross-section, linear antenna arrays, broadcast arrays, effect of earth.

UNIT-IV ANTENNA SYSTEMS

Non-resonant antennae, Yagi-Uda and Rhombic antennae, UHF and microwave antenna: antenna with parabolic reflectors, horn and lens antenna, Turnstile and Clover leaf antenna, wideband and special purpose antennae: Helical discone, log-periodic and loop antennae.

UNIT-V RADIO WAVE PROPAGATION

Different ways of radio wave propagation, effects of environment on radio wave propagation. Ground (surface) waves and their characteristics, sky-wave propagation: the ionosphere and its effects, reflection mechanism, virtual height, critical frequency, maximum usable frequency, skip distance transmission path and fading, diversity techniques, Ionosphere variation, space waves: microwave spacewave propagation, troposphere scatter propagation.

Pre-requisite Electromagnetic Field Theory

Course/Paper:

Text Book: Jordan E C & K G Balmain, "Electromagnetic Waves and Radiating Systems", PHI Pvt. Ltd, New Delhi, 1987

Reference Books: J.D. Kraus, "Antenna and wave propagation", Mc-Graw Hill, 4^{th} edition.

Course Outcomes

CO1: Students will be able to understand the concept of electromagnetic waves and its propagation in different mediums.

CO2: Students will be able to understand bounded propagation of electromagnetic waves through waveguides and derive their characteristics.

CO3: Students will be able to understand the operation of infinitesimal current element as a dipole antenna and workout its fields, power radiated and radiation pattern.

CO4: Students will be able to understand various types of antennas such as horn, loop, rhombic etc. and derive its various parameters for optimization.

CO5: Students will be able to understand different types of radio wave propagation and atmospheric effects on radio wave propagation