EC442- Electromagnetic Wave Propagation

CREDIT HOURS

3 Hours

CONTACT HOURS (Hours/week)

Lecture: 2; Tutorial: 2

COURSE COORDINATOR

Dr. Mohammed Abou-El Dahb

TEXT BOOK

- Nathan Ida, Engineering Electromagnetics,

COURSE DESCRIPTION

Wave equation, Uniform plan waves, Wave propagation in free space, perfect dielectric, lossy and good conductors, skin effect, surface impedance. Normal incidence, reflection coefficient and standing wave pattern. Input impedance, Oblique incidence reflection coefficients for horizontal and parallel polarization Brwester angle, and types of polarization. Fundamental parameters of antennas,. Linear wire antenna (infinitesimal, small, finite length dipole, and half-wavelength dipole). Ground wave propagation .Troposphere propagation. Ionosphere wave propagation.

PREREQUISITE:

EC 341

RELATION OF COURSE TO PROGRAM

Required

COURSE INSTRUCTION OUTCOMES

The student will be able to:

- Apply wave theory to uniform plane waves in different media.
- Investigate its performance when incident on a boundary between two mediums.
- Investigate radio wave propagation channels in medium, high and very high frequencies.
- Investigate different mechanisms of wave propagation.

TOPICS COVERED

- Wave equation "its solution in case of Free Space & Perfect Dielectric Medium"
- Solution of wave equation in a lossy dielectric medium "Propagation Constant, Intrinsic Impedance, Electric and magnetic field, Loss Tangent, Average Power,"
- Solution of wave equation in Good Conductors "Propagation Constant., Intrinsic Impedance, Electric, Magnetic Field Equation, Skin Depth, Power Losses."

- Normal incidence of uniform plane wave "Reflection coefficient, Transmission coefficient, Standing Wave and Standing Wave Ratio, Input impedance"
- Oblique incidence of uniform plane wave on a boundary (Γ,Brwester angle, Critical Angle)."
- "Total Internal Reflection, Surface impedance (Zs).,Polarization Types"
- Fundamental parameters of Antennas (Radiation pattern, Directivity, Gain, Antenna efficiency, HPBW, Beam efficiency, Bandwidth, Polarization, Input impedance)
- Radiation integrals and auxiliary potential functions (Magnetic and electric vector potentials, Solution of the inhomogeneous vector potential wave equation)
- Linear wire antennas (infinitesimal dipole, small dipole, finite length dipole, half-wavelength dipole)
- Radio wave propagation "Classification of radio waves, Free space and Ground Wave propagation, reflection of radio waves from the earth's surface"
- Tropospheric wave propagation "General properties of the troposphere, Effect of troposphere on ground wave, Effective earth's radius,"
- Ionospheric wave propagation "The constitution and structure of the upper atmosphere, Physical processes in the propagation of different waves,"

CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:

Professional component Content			
Math and Basic Sciences	Engineering Topics	General Education	Other
	✓		

RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:

	Student Outcomes	Course aspects
A	An ability to apply knowledge of mathematics, science, and engineering	a_1 a_2
B	An ability to design and conduct experiments, analyze and interpret data.	
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability	
D	An ability to function on multi-disciplinary teams.	
E	An ability to identify, formulate, and solve engineering problems	e_1 e_2 e_3
F	An understanding of professional and ethical responsibility	
G	An ability to communicate effectively	
H	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social content	
I	A recognition of the need for, and an ability to engage in life-long learning.	
J	A knowledge of contemporary issues within and outside the electrical engineering profession.	
k	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	k