FUTURE UNIVERSITY IN EGYPT جامعة المستقبل

Faculty of Engineering & Technology

Electromagnetic Waves

Information :

Course Code :	COM 413	**Level :**	Undergraduate	**Course Hours :**	3.00- Hours

Department : Specialization of Electronics & Communication

Instructor Information :

Title	Name	Office hours
Professor	Mahmoud Abdelrahman Abdelfattah Abdallah	2
Assistant Lecturer	Ahmed Essam Fahim Zahran	

Area Of Study :

1- Enrich students' knowledge of the transmission line analysis.
2- Develop students' skills wave transmission, reflection and refraction.
3- Increase students' background knowledge of the protection and electromagnetic wave safety levels.

Description :

The course aims to provide a coverage of the boundary conditions and the Transmission Lines T.L equivalent circuit. Lumped and distributed elements circuits. The distributed parameters of the Transmission line, Lumped ï element model of a section of the TL .TEM T.L. Partial Differential equations for the wave propagation on a lossy and lossless T.L. Characteristics of a two conductors T.L.: Propagation Constant, attenuation constant, the characteristic impedance. Wave reflection and transmission at discontinuities. Voltage Standing Wave Ratio (VSWR), Input impedance for a Transmission Line loaded with an impedance ZL .The Smith Chart. Applications on Smith Chart. Single stub line matching on Smith Chart. The Wave equation derived from Maxwell's equations for time harmonic fields.Plane Waves in free space. Wave velocity. Wave number and Wave length. The Wave equation in a general lossy and lossless media with parameters (ủ, ε, ů) .The Waves in a conducting, semiconducting, and in dielectric media. Polarization of electromagnetic waves. The reflection coefficient of a Horizontal polarized wave. The reflection coefficient of a Vertical polarized wave. Brewster angle for the vertical polarized waves. Atmospheric refraction of electromagnetic waves. Standard parameters of the troposphere. The refractive index. Types of atmospheric refractions. The ionospheric layers. The safety levels during exposure to electromagnetic fields.

Course outcomes :

a.Knowledge and Understanding: :	
1 -	a1. Estimate the input impedance, the reflection coefficient, and Voltage Standing Wave Ratio on the transmission line with a given load impedance.
2 -	a2. Discuss the matching problem using Smith chart and analytical methods.
3 -	a3. Estimate the reflection coefficients for the horizontal and vertical polarized waves.
4 -	a4. Recognize the different types of tropospheric refraction, the main characteristics of the ionosphere, and the different ionospheric layers.
5 -	a5. Recognize the safety protection levels of exposure to electromagnetic waves.
b.Intellectual Skills: :	
1 -	b1. Analyze the characteristics of distributed circuit, and Transmission Line Parameters.

2 -	b2. Evaluate the stub matching problems using Smith Chart and numerical methods.
3 -	b3. Analyze the electromagnetic wave propagation in different media.
4 -	b4. Evaluate the electromagnetic wave reflections, refraction problems, interact with the tropospheric and ionospheric problems
5 -	b5. Apply the safety level values during exposure to electromagnetic fields.
c.Professional and Practical Skills: :	
1 -	c1. Practice the guide wavelength measurements
2 -	c2. Practice the VSWR and the reflection coefficient measurements.
d.General and Transferable Skills: :	
1 -	d1. Communicate effectively.
2 -	d2. Refer to relevant literatures.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Definition of Transmission Lines. Lumped and distributed elements circuits. The distributed parameters of the Transmission Lines Lumped and distributed elements.	5	3	2
Lumped ï element model of a section of the TL . Partial Differential equations for the wave propagation on a lossy and lossless T.L. Characteristics of the T.L. : Propagation Constant , attenuation constant , the characteristic impedance. Problems on the propagation constant , attenuation constant, the characteristic impedance of the transmission line.	10	6	4
Wave reflection and transmission at discontinuities. Voltage Standing Wave Ratio (VSWR). Input impedance for a Transmission Line loaded with an impedance ZL . Calculations of the reflection , transmission coefficients and (VSWR	5	3	2
The Smith Chart. Applications on Smith Chart. Single stub line matching on Smith Chart. The Wave equation derived from Maxwell's equations for time harmonic field. Applications on Smith Chart. Input impedance and stub matching. Mid -Term 1	10	6	4
The Wave equation derived from Maxwell's equations for time harmonic field. Applications on Smith Chart. Input impedance and stub matching. Mid -Term 1	5	3	2
Waves in free space. Wave velocity. Wave number and Wave length. Relations between wave parameters	5	3	2
The Wave equation in a general medium with parameters (ủ , ε , ů) .The Waves in a conducting , semiconducting , and in dielectric medii. Calculations on conducting , semiconducting , and in dielectric medii. Polarization of electromagnetic waves. The reflection coefficient of a Horizontal polarized wave.	15	9	6
Calculation of the reflection coefficient for the Horizontal polarized wave. The reflection coefficient of a Vertical polarized wave. Brewster angle for the vertical polarized waves. Calculation of the reflection coefficient and Brewster angle for the Vertical polarized wave. + Mid-Term 2.	5	3	2
Atmospheric refraction of electromagnetic waves. Standard parameters of the troposphere Standard and the true parameters of the troposphere. The refractive index.	5	3	2

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Types of atmospheric refractions. Different types of atmospheric refractions. Characteristics of each one. Ionospheric layers. Characteristics and equivalent parameters of ionosphere. Electromagnetic waves, Health and Safety standards.	10	6	4

Teaching And Learning Methodologies :

Interactive Lecturing
Discussion
Problem Solving
Experiential Learning

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
ÅFinal exam	40.00		
o In Class Quizzes and Performance	10.00		
o Mid-Term Exams	50.00		