415 CNE Course Syllabus

Course Code	415 CNE
Course Name	Antenna Engineering
Credit Hours	3 (2 for theory and 1 for lab)
Contact Hours	4 (2 for theory and 2 for lab)
Instructor Name	Dr. Ashraf Mahmoud Abdelrahman

Text Book (title, author, and year)
• Modern Antenna Handbook, C. A. Balanis, John Wiley & Sons.2008. • Antenna Theory and Design, R. S. Elliot,Wiley-IEEE Press., 2003.

Specific Course Information	
Catalog Description	This course focuses on the fundamentals of antennas, analysis, synthesis and computer-aided design, and applications in communications, remote sensing, and radars.
Prerequisites	CNE322
Co-requisites	NIL
Required/Elective	required

Course Learning Outcomes	
1	To define contemporary issues in antenna engineering and summarize modern antenna techniques and concepts and recognize their fundamental parameters.
2	To explain the theory of different types of antennas used in different communication systems.
3	To calculate the antenna gain, directivity, and power radiated of simple dipole and loop antenna.
4	To apply the analysis and design principles for designing antennas for various applications and calculate their pattern measurements.
5	To create an optimum antenna specifications for a given communications application.
6	To conduct simulation experiments for designing and evaluating antenna systems.
7	To demonstrate the ability for presenting oral and written mini-projects for different antenna systems.

Mapping course LOs to the SLO.												
Course LOs #	Student Learning Outcomes											
	a1	a2	b1	b2	b3	b4	b5	c1	c2	c3	d1	d2
1		√										
2			√									
3			√									
4			√	√								
5				√	√							
6							√					
7												
8												√

List of Theory Topics

Antenna Theory and Types: Wire antennas, aperture antennas, micro strip antennas, array antennas, reflector antennas, lens antennas.
Fundamental Parameters of Antenna: Physical concept of radiation, Radiation pattern, Radiation pattern lobes, Isotropic, Directional and Omni directional patterns, Field Regions**.**
Radiation power density and Poynting vector: Radiation Intensity, Beamwidth and Bandwidth Directivity, Gain and Absolute gain, Antenna Efficiency and Beam efficiency**.**
Antenna Equivalent Area: Friis Transmission Equation, Radar Range Equation.
Wire Elements: Infinitesimal dipole, Radiated fields, Power density and Radiation resistance, Field region, Directivity, finite length dipole, Current distribution, Radiation intensity, Directivity, Half Wave dipole.
Loop Antennas: Small circular loop, Radiated fields, Small loop and infinitesimal magnetic dipole, Radiation resistance and Power density, Near field and Far field regions, Radiation intensity and directivity, applications and uses.
Aperture Antennas and Reflector Antennas: Broadband Antenna and Microstrip Antennas.

List of Lab Experiments

1. Introduction to antenna designing simulator tool-High Frequency Structure Simulator
2. Design, simulate and analyze waveguide for rectangular patch antenna in HFSS
3. Design, simulate and analyze waveguide for probe feed patch antenna using HFSS.
4. Design and simulate triangular micro strip antenna and dual mode conical horn antenna.
5. To study phenomenon of linear, circular and elliptical polarization.
6. To find out the beam area of antenna using MATLAB.
7. To find out the directivity (normal value and dB value) of an antenna using MATLAB.
8. To plot the 2D and 3D radiation pattern of Omni-directional antenna in MATLAB.
9. To plot the 2D and 3D radiation pattern of Directional antenna in MATLAB.
10. To study and plot the array pattern and power pattern of the linear arrays.
11. To study and plot the radiation pattern of the End-fire arrays, and Broad-side arrays.
12. Radiation pattern of uniform linear arrays and non-uniform (binomial) array antenna.
13. Design of Yagi-Uda antenna.