Jordan University of Science and Technology

Faculty of Engineering

Electrical Engineering Department

EE407 Antennas And Radio Wave Propagation - JNQF Level: 7

First Semester 2023-2024

Course Catalog
3 Credit Hours. Antenna principles and types; Antenna parameters (gain, beamwidth, aperture, impedance, polarization); Ideal and practical dipoles; Antenna arrays; Microstrip antennas; Friis transmission formula and radar equation; Radiowave propagation mechanisms in various environments and the associated path loss models; Biological effects of radiation on humans and international safety standards. Design Project.

Text Book	
Title	Antennas and Radiowave Propagation
Author(s)	R. E. Collin
Edition	1st Edition
Short Name	Textbook
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #1	Antenna theory: Analysis and Design	C. A. Balanis	2nd Edition	
Ref #2	Antennas and Propagation for Wireless Communication Systems	Simon R. Saunders and A. A. Zavala	2nd Edition	
Ref # 4	"Waves and Fields of Wireless Communications and Electricity: Health-Effects and Unconventional Utilizations"	Mohammed Saleh Al Salameh	1st Edition	

Instructor	
Name	**Prof. Majid Khodier**
Office Location	E2L3

Office Hours	Sun : 09:30 - 10:30 Sun : 12:30 - 14:30 Mon : 11:30 - 13:00 Tue : 09:30 - 10:30 Thu : 10:30 - 12:30
Email	majidkh@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Sun, Tue : 10:30 - 11:30 Room: LAB

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
243071	EE307 Electromagnetic (2)	Prerequisite / Study

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Weeks 1, 2	Historical review, antenna principles and types and radiation from elementary antennas.	From **Textbook**, From **Ref #1**
Weeks 3, 4	Antenna parameters	From **Textbook**, From **Ref #1**
Week 5	Antenna arrays	From **Textbook**, From **Ref #1**
Week 7	Friis transmission formula and radar equation	From **Textbook**, From **Ref #1**
Weeks 8, 9	Propagation over flat and spherical earth	From **Textbook**
Week 9	Effects of diffraction on wave propagation	From **Textbook**
Week 10	Surface-wave propagation	From **Textbook**
Weeks 10, 11	Propagation in the ionosphere	From **Textbook**
Weeks 12, 13	Propagation in urban and sub-urban areas: theoretical models, statistical models	From **Ref #2**
Weeks 14, 15, 16	Biological effects of radiation, and RF exposure standards	From **Ref #2**, From **Ref # 4**
Week 6	Introduction to microstrip antennas.	From **Ref #1**

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Explain the radiation process and the importance of antennas in communications systems. Distinguish between different types of antennas. Illustrate the radiation from basic antenna elements and calculate important antenna parameters (radiation resistance, gain, directivity, effective area, beamwidth, etc.) [1SO1] [1L7K1]	20%	First Exam, Final Exam
Acquire introductory knowledge about the operation, design, and radiation properties of microstrip antennas. [1SO7] [1L7S2]	5%	First Exam
Discuss the operation of antenna arrays, their categories, and the ability to design and calculate the radiation from linear antenna arrays. [1SO1] [1L7K1]	5%	Final Exam
The ability to use Friis transmission formula and radar equation in the design of communication systems. [1SO1] [1L7K1]	5%	Final Exam, Second Exam
Explain radiowave propagation mechanisms in different environments and how appropriate path loss model is derived for each mechanism and the ability to apply these models in the design of communication systems. [1SO1, 1SO7] [1L7S1]	40%	Final Exam, Second Exam
Explain the biological effects of radiation on humans and how to apply international exposure safety standards in this regard. [1SO2, 1SO7] [1L7S2]	10%	Final Exam
The ability to design and simulate a microstrip antenna using suitable tools and acquire basic knowledge on how to fabricate and measure its performance. The ability to analyze the results and compare the measured performance to the simulated performance and explain and justify any discrepancies. Write and submit a formal report and present the results to the class. [2SO2, 1SO3, 1SO5] [1L7S3]	15%	Midterm Project

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
50	12.5	3.75		3.75		30

Relationship to NQF Outcomes (Out of 100%)			
L7K1	L7S1	L7S2	L7S3
30	40	15	15

Evaluation	
Assessment Tool	**Weight**
First Exam	25%
Final Exam	40%
Midterm Project	15%
Second Exam	20%

Policy	
Grading	First Exam 25% Second Exam 20% Design Project 15% Final Exam 40%
Design Project details	1. Each student shall collaborate with a classmate by forming groups of two to work on the project. 2. The student can work alone on the project if he/she wishes so. 3. Each group shall survey the literature and choose a recent paper (at maximum 5 years old) that deals with the design of microstrip antennas or very related subject, study it, and utilize a suitable simulation software to simulate the antenna performance and verify and optimize the antenna geometry for best performance. 4. The final antenna design of each group will be fabricated in our PCB fabrication lab. 5. The performance of the fabricated antenna will be measured using the available vector network analyzer. 6. Each group shall submit a written formal report explaining the whole process of design, simulation, fabrication and measurement of the chosen antenna, discussing the results and explain and justify discrepancies between preliminary design, simulation and measurement results. 7. Each group will make a 10-minute presentation of the project and the used simulation tool before other students

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