Course Specification

(Postgraduate Programs)

Course Title:	Advanced Engineering Electromagnetics
Course Code:	2202-501
Program:	Master in Electrical Engineering
Department:	Electrical Engineering
College:	College of Engineering
Institution:	King Faisal University
Version:	V2
Last Revision Date:	17 April 2025

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐ University	☐ College	☒ Department	☐ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: Level 2/ 1st Year				
4. Course General Description:				
Review of Maxwell's Equations; Electromagnetic theorems and principles; electromagnetic waves in lossy and anisotropic media; Waves at plane boundaries; Guided waves; Introduction to radiation and scattering; Spectral domain techniques; Computational programming with an emphasis on simulating electromagnetic waves.				
5. Pre-requirements for this course (if any)**:**				
2202-331 Engineering Electromagnetism				
6. Co-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				

- Develop a strong background in electromagnetic theory and understand and use various mathematical tools to solve Maxwell equations in problems of wave propagation and radiation.
- Develop the knowledge of Electromagnetic Wave Transmission, transmission lines: frequency domain analysis including power relations and graphical representation.
- Acquainting the students with the knowledge of Electromagnetic waves conducting waveguides and dielectric waveguides.
- To make students familiar with the concept of Radiation: elemental dipoles, radiating antenna and characterization.
- Develop competence in using computers for computation and software simulation.

- Strengthen oral technical communication skills.
- Work in a team, conduct research work, and write project reports.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid ● Traditional classroom ● E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lecture**	45
2.	**Laboratory/Studio**	10
3.	**Seminars**	10
4.	**Others** (specify) Introduction to Simulation Software	5
	Total	70 Hours

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Strengthen the background in electromagnetic theory and	K1	Lectures Solved Examples	Homework Assignments Examination

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	understand and use various mathematical tools to solve Maxwell equations.			
1.2	Understand the electromagnetic wave transmission and transmission lines.	K1	Lectures Solved Examples	Homework Assignments Examination
1.3	Understand the concept of Radiation: elemental dipoles, radiating antenna, and characterization.	K1	Lectures Solved Examples	Homework Assignments Examination
1.4	Recognize the behavior of Electromagnetic waves in conducting waveguides and in dielectric waveguides.	K1	Lectures Solved Examples	Homework Assignments Examination
2.0	**Skills**			
2.1	Recognize the behavior of Electromagnetic waves in conducting waveguides and in dielectric waveguides.	S1	Lectures Solved Examples	Assignments Examination Software simulation
2.2	Use software and simulation tools for EM field computations.	S2	Software simulation	Report submission
3.0	**Values, autonomy, and responsibility**			
3.1	Conduct a research project to identify the effect of EM radiation and the	V1, V2, V3	Research project	Submitted report Project discussion

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	electromagnetic compatibility (EMC).			

C. Course Content:

No	List of Topics	Contact Hours
1.	Review of Maxwell's Equations	6
2.	Apply Maxwell‘s equations to solutions of problems relating to transmission lines and uniform plane wave propagation.	6
3.	The properties of electromagnetic waves in dielectrics and conductors.	6
4.	The behavior of electromagnetic waves at the boundaries between different media.	6
5.	The transmission of electromagnetic waves in waveguides.	9
6.	Electromagnetic scattering and high-frequency scattering	3
7.	Principles of operation of basic classes of antennas	3
8.	Computational programming, with an emphasis on field calculation and simulation of electromagnetic waves.	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	Week 3	**15%**
2.	Assignments	Week 5	
3.	Assignments	Week 7	
4.	Assignments	Week 9	
5.	Assignments	Week 11	
6.	Assignments	Week 14	
7.	Midterm	Week 9	**25%**
8.	Research Paper and oral discussion	Week 13	**25%**
9.	Final Exam	Week 16	**35%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	William H. Hayt, Jr. and John A. Buck, Engineering Electromagnetics, 9th ed., McGraw Hill (2019)

Supportive References	Roger F. Harrington, Time Harmonic Electromagnetic Fields. IEEE Press/Wiley, New York, 2001.
Electronic Materials	Handouts by the instructor.
Other Learning Materials	Scientific journal reading.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom: 30 seats
Technology equipment (Projector, smart board, software)	Data show Maxwell's software EM virtual lab
Other equipment (Depending on the nature of the specialty)	Computer Lab

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect- Online Survey
Effectiveness of students' assessment	Students and Faculty	Direct and Indirect Assessment
Quality of learning resources	Students and Faculty	Indirect- Online Survey
The extent to which CLOs have been achieved	Students and Faculty	Direct and Indirect Assessment
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**EE DEPARTMENT QUALITY COMMITTEE**
REFERENCE NO.	**MEETING # 10**
DATE	**APRIL 19, 2025**