

Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering		المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة
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Advanced Electromagnetic Theory

College: Engineering

Department: Electrical Engineering

First: Course Definition

1- Course Code: EE612

2- Units (3)

3 – Semester (1)

4 -Prerequisite of the course : EE

5- Co-requisite: Electromagnetic theory and fundamentals: Static and dynamic electromagnetic fields; forces and work in electromechanical systems; magnetic circuits; plane wave propagation; reflection of plane waves; uniform transmission lines.

6- Location (if not on main Campus):

Second: Course Objectives

- Develop the knowledge of Electromagnetic Wave Transmission, transmission lines: frequency domain analysis of radio frequency and microwave transmission circuits including power relations and graphical and computer methods.
- Acquainting the students with the knowledge of Electromagnetic waves: planar optical components, pulse dispersion, phase front considerations for optical components, conducting waveguides, dielectric waveguides.
- To make students familiar with the concept of Radiation: retarded potentials, elemental dipoles, radiating antenna characterization, receiving mode.

Third: Course Specifications

1- Topics to be covered		
Subject	No of Weeks	Hours
Introduction: - review of Maxwell's equations and plane wave propagation	1	2
Multiport RF networks:	4	12

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<ul style="list-style-type: none"> - TEM transmission lines, including parallel-plate, coaxial, and two-wire liners - Quasi-TEM transmission lines, including microstrips 		
Time-harmonic analysis of the transmission impedance transformations and reflection coefficients for terminated transmission lines Smith Chart impedance matching networks, including quarter-wave transformers, single-stub tuners, and double-stub tuners	3	8
higher-order modes on parallel-plate waveguides Rectangular waveguides, Dielectric slab waveguides Elemental antennas (infinitesimal dipoles and small loops)	3	8
Finite-length dipole antennas Transmitting and receiving properties of antennas Gain, directivity, radiation patterns, beam width, radiation resistance, input impedance, radiation efficiency	3	8
<ul style="list-style-type: none"> - Antenna arrays 	2	4

2- Course components (Total hrs in the Semester)

Lecture	Exercise	Lab	Other
42	6	8	

3- Intended Learning Outcomes of the Course (ILO's)

a. Knowledge

i) Description of the knowledge to be acquired:

The course focuses on Electromagnetic theory and fundamentals: Static and dynamic electromagnetic fields; forces and work in electromechanical systems; magnetic circuits; plane wave propagation; reflection of plane waves; uniform transmission lines.

ii) Teaching strategies to be used to develop that knowledge

- Lectures
- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, internet search, and reporting)

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iii) Methods of assessment of knowledge acquired

- **Quizzes:** to assess understanding of the course knowledge.
- **Assignment reports:** to assess ability to answer some comprehensive questions.
- **Midterm Exams:** to assess understanding of the course knowledge.

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- The ability to analyze the different electromagnetic waves and proper used mode,
- The ability to design an accurate /sensitive signal conditioning systems by using the electromagnetic analysis ,
- The ability to propose new methodology of conditioning the different waves.

ii) Teaching strategies to be used to develop these cognitive skills

- Lectures
- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, Internet search, and reporting)

iii) Methods of assessment of students cognitive skills

- **Quizzes:** to asses the ability to solve quickly some problems.
- **Assignment reports:** to asses the ability to solve and analyze some comprehensive problems.
- **Midterm Exams:** to assess the ability to discuss, analyze, and solve the associated problems.
- **Final Exam:** to assess the intellectual skills such as analytical skills and ability to solve machine problems
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c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Team work
- Ideas development and sharing with others

ii) Teaching strategies to be used to develop these skills

- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, Internet search, and reporting)

iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- **Unified reports and Seminars:** to assess the integration done by the student in a unified report and presentations.
- **Oral Group Exams:** to assess interactive and communication abilities.

d. Communication, Information Technology and Numerical Skills

- i) Description of the skills to be developed in this domain*
- Use of the internet search
 - Technical report writing
- ii) Teaching strategies to be used to develop these skills*
- Assignments, at home
 - Assignment Reports (data collection, Internet search, and reporting)
- iii) Methods of assessment of students numerical and communication skills*
- Assignment Reports: to assess technical report writing abilities.
 - Discussion Groups: to assess interactive and communication abilities.-

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required
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ii) Teaching strategies to be used to develop these skills-
.....=

iii) Methods of assessment of student's psychomotor skills
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4- Student Assessment Schedule

Serial	Assessment tool (test, group project, examination etc.)	Week due	Weight
1	Quiz (1)	4	2%
2	Mid-Term(1)	6	15%
3	Quiz (2)	8	2%
4	Mid-Term Exam (2)	12	15%
5	Attendance		2%
6	Home work-Mini-project	13	14%
6	Final Exam	16	50%

5- Student Support

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Four office hours per week are offered by the instructor to aid the students and support them.

6- Learning Resources

- **Essential Books (References)**
- 1- Field and Wave Electromagnetics, 2nd ed., D. Cheng (Addison-Wesley, 1989).
- 2- Fields and Waves in Communication Electronics, 3rd ed., Ramo, Whinnery, and van Duzer (Wiley 1994)
- 3- Electromagnetic Waves, Staelin, Morganthaler, and Kong (Prentice Hall, 1994); Microwave Engineering, D. Pozar (Wiley 1997)

- ii) **Course Notes**
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- iii) **Recommended Books**
Field and Wave Electromagnetics, 2nd ed., D. Cheng (Addison-Wesley, 1989).
- 1-
- iv) **Electronic Books & Web Sites:**
- Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students.

- v) **Essential Tools**
Laboratory space and equipment required:
 - 1- The E-CAD room or equivalent is required to teach the simulation software and to allow students to do the first piece of course work.
 - 2- Advanced Design System (ADS) with Applications to Engineering, Physics. This shows how to solve engineering design problems using ADS.**Software requirements**
 - 1- ADS software license

7- Course Evaluation and Improvement Processes

- i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching
 - Questionnaire,
 - Observing the students opinions recorded in the college student site
 - Appeal box
 - Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college.
- ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department
 - Periodical review of the teaching methods by both the department council and the education affairs vice dean.-
 - Questionnaire,
 - Observing the students opinions recorded in the college student site

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iii) Processes for Improvement of Teaching <ul style="list-style-type: none"> • Evaluation of the course outlines by external staff member from outside the university • Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.
iv) Processes for Verifying Standards of Student Achievement It is planned to: <ul style="list-style-type: none"> • Check marking of a sample of student work by an independent faculty member. • Exchange periodically, and remark a sample of assignments with a faculty member in King Saud University (KSU).
v) The planning arrangements for periodically reviewing course effectiveness and planning for improvement. <ul style="list-style-type: none"> - Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university), - Consequently, actions are to be taken to improve the course delivery when necessary. - Review of the course objectives, outcomes and curriculum each 2 years.