

<p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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Antennas and Radio Waves Propagation

College: College of Engineering

Department: Electrical Engineering Department

First: Course Definition

1- Course Code : EE 626

2- Units : 3

3 – Semester : First or Second

4 -Prerequisite : Knowledge of Maxwell's Equations, good background in vectors

5- Co-requisite

6- Location (if not on main Campus):

Second: Course Objectives
Upon completion of this course, the student will:

- 1. Be acquainted with various types of antennas and different methods of their analysis.**
- 2. Develop the concepts of antenna arrays and their applications.**
- 3. Be aware of broadband antennas as a frequency independent sort of antennas.**
- 4. Be able to appreciate the role of aperture antennas in communication systems.**

Third: Course Specifications

1- Topics to be covered		
Subject	No of Weeks	Units
Review of Maxwell's equations and plane waves Time varying fields, Integral and differential forms of Maxwell's equations, Development of wave equation	1	3
Fundamental parameters of antennas	3	9

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Radiation pattern, Power intensity, Radiated power, Directivity, Gain, Radiation resistance		
Radiation integrals and potential functions Electric potential, vector magnetic potential	2	6
Wire antennas Linear wires of different lengths, Loop antenna	2	6
Arrays (analysis and synthesis) Linear uniform arrays, planar, circular arrays	3	9
Broadband antennas Concept of frequency independent antennas	2	6
Aperture Antennas Aperture-far field relationship, horn antennas	2	6

2- Course components (Total hrs in the Semester)

Lecture	Exercise	Other
45	15	

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

a. Knowledge

i) Description of the knowledge to be acquired:

- Knowledge and Understanding of:

- Electromagnetic wave propagation in different scenarios.
- The role of antennas in communication systems.
- Antenna parameters and an appropriate selection of antennas suitable to the application at hand.
- Antenna system analysis.
- Antenna arrays analysis and design
- Microwave antennas and their applications.

ii) Teaching strategies to be used to develop that knowledge

- Lectures
- Assignments
- Discussions in the Class
- Case study Report (data collection, Internet search, and reporting)
- Mini project (Design - Hardware / Software / Measurements)

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- Summer Training, Supervised
 - Collaborative Training, Supervised
- iii) Methods of assessment of knowledge acquired**
- **Quizzes:** to assess understanding of wave propagation fundamentals
 - **Case Study (Report):** to assess technical report writing simulation abilities.-
 - **Discussion Groups:** to assess interactive and communication abilities.
 - **Midterm Exams:** to assess understanding of digital circuit fundamentals, problem solving and analytical and design capabilities.
 - **Final Exam:** to assess **understanding** of different aspects in the ILO's, design capabilities, analytical skills and ability to solve antenna problems.
 - **Group Mini project:** to assess **practical hands-on**, team work, report writing, ability to deal with suppliers, and design of antenna systems.

b- Cognitive (Intellectual) Skills

- i) Cognitive skills to be developed**
- Ability to analyze and simulate an antenna system.
 - Ability to design antenna systems.
 - ability to select a suitable antenna for the communication system.
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- ii) Teaching strategies to be used to develop these cognitive skills**
- Lectures
 - Assignments
 - Discussions in the Class
 - Case study Report (data collection, Internet search, and reporting)
 - Mini project (Design - Hardware / Measurements), Supervised
 - Summer Training, Supervised
 - Collaborative Training, Supervised
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iii) Methods of assessment of students cognitive skills

- **Quizzes:** to assess understanding of wave propagation fundamentals
- **Case Study (Report):** to assess technical report writing simulation abilities.
- **Discussion Groups:** to assess interactive and communication abilities.
- **Midterm Exams:** to assess understanding of antenna fundamentals, problem solving and analytical and design capabilities.
- **Final Exam:** to assess **understanding** of different aspects in the ILO's, design capabilities, analytical skills and ability to solve antenna problems.

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- **Group Mini project:** to assess **practical hands-on**, team work, report writing, ability to deal with suppliers, and design of antenna systems.

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

- Lectures
- Assignments, at home
- Discussions in the Class
- Case study Report (data collection, Internet search, and reporting)
- Mini project (Design - Hardware / Software / Measurements), Supervised
- Summer Training, Supervised
- Collaborative Training, Supervised
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iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- **Quizzes:** to assess understanding of wave propagation fundamentals
- **Case Study (Report):** to assess technical report writing simulation abilities.
- **Discussion Groups:** to assess interactive and communication abilities.
- **Midterm Exams:** to assess understanding of antenna fundamentals, problem solving and analytical and design capabilities.
- **Final Exam:** to assess **understanding** of different aspects in the ILO's, design capabilities, analytical skills and ability to solve antenna problems.
- **Group Mini project:** to assess **practical hands-on**, team work, report writing, ability to deal with suppliers, and design of antenna systems.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- Ability to understand fixed and mobile antenna system,
- Ability to design antenna systems, to perform a certain function
- Acquiring the hands on of practical antenna measurement systems
- Technical report writing
- Ability to use shareware software available in the internet

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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

- **Case Study (Report):** to assess technical report writing simulation abilities.
- **Discussion Groups:** to assess interactive and communication abilities.
- **Group Mini project:** to assess **practical hands-on**, team work, report writing, ability to deal with suppliers, and design of antenna systems.

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

- Not Applicable
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ii) Teaching strategies to be used to develop these skills-

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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
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1	Quiz	2, 6, 10	
2	Assignment	everyweek	
3	Term Paper	4, 12	
4	Mid-term exam	8	
5	Final exam	16	

5- Student Support

- Office hours of at least 4 hours per week are offered
- Group news via Email, LinkedIn, etc
- Teaching assistance staff to offer extra support

6- Learning Resources

i) Essential Books (References)

C. Balanis, “*Antenna Theory Analysis and Design*”, 2nd Edition, John Wiley, 1997.

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ii) Course Notes

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iii) Recommended Books

1. M. Sadiku, *Elements of Electromagnetics*, Oxford University Press, 1994.
2. R. Collin, *Antennas and Radiowave Propagation*, McGraw Hill, 1985.
3. W. Stutzman, and G. Thiele, *Antenna Theory and Design*, John Wiley, 1998.
4. R. Elliott, *Antenna Theory and Design*, Prentice Hall, 1985.

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iv) Electronic Books & Web Sites-

- Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students.

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v) Periodicals

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- IEEE Trans. Antennas and Propagation

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7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Questionnaires
- Observing the students opinions recorded in the college student site
- Appeal box
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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.
- Questionnaires
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iii) Processes for Improvement of Teaching

- 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.
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iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

It is planned to:-

- 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 one of distinguished institutes.

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

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.-

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- Review of the course objectives, outcomes and curriculum at about 2 years span
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