

<b>Kingdom of Saudi Arabia</b> Ministry of Higher Education <b>Qassim University</b> College of Engineering		المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة
--	--	--

## Advanced Course on Filters and Amplifiers

**College: Engineering**

**Department: Electrical Engineering**

**First: Course Definition**

**1- Course Code: EE611**

**2- Units (3)**

**3 – Semester (2)**

**4 -Prerequisite -None**

**5- Co-requisite**

- Basic knowledge in Electromagnetic and analog Electronic
- Electrical and Computer Engineering course “Electromagnetic Fields” or equivalent, or permission of the instructor

**6- Location (if not on main Campus):**

**Second: Course Objectives**

- Acquainting the students with the necessary knowledge to be able to design and analyze various microwave passive (filters, couplers, combiners/dividers) circuits.
- To ensure that students know some characteristic properties of active circuits (linear amplifiers and oscillators).
- Give students an appreciation of the transmission line theory, impedance matching techniques, and microwave circuit network analysis.
- Develop knowledge to design of practical microwave circuits such as filters, couplers, low-noise, amplifiers, and oscillators.

**Third: Course Specifications**

<b>1- Topics to be covered</b>		
Subject	No of Weeks	Hours
<b>Introduction:</b> Transmission line theories and generalized matrix representation of RF circuits	<b>1</b>	<b>4</b>
<b>Multiport RF networks:</b>	<b>2</b>	<b>8</b>

<b>Kingdom of Saudi Arabia</b> Ministry of Higher Education <b>Qassim University</b> College of Engineering		المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة
--	--	--

Analysis of multi-port RF networks equivalent circuit, Lumped circuits in Multiport networks distributed microstrip circuits		
<b>Analysis of microstrip circuits</b> <ul style="list-style-type: none"> <li>• Microstrip couplers, hybrids and impedance matching networks</li> <li>• Microwave Filters and resonators</li> </ul>	<b>2</b>	<b>8</b>
<ul style="list-style-type: none"> <li>• Design of RF low noise amplifiers (LNAs)</li> <li>• Design of RF oscillators and mixers</li> </ul>	<b>2</b>	<b>8</b>
Use of existing commercial CAD design tools for RF circuits	<b>2</b>	<b>8</b>
Hybrid and Monolithic RF circuits	<b>1</b>	<b>4</b>

**2- Course components (Total hrs in the Semester)**

Lecture	Exercise	Lab	Other
<b>42</b>	<b>6</b>	<b>8</b>	

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

**a. Knowledge**

**i) Description of the knowledge to be acquired:**

- Develop and apply the principles of the different filters according to their applications,
- Develop interdisciplinary knowledge of every filter and amplifier limitations,
- Apply your knowledge to resolving problems in new or relatively unknown environments
- 

**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)

**iii) Methods of assessment of knowledge acquired**

- **Quizzes:** to assess understanding of the course knowledge.

<p>Kingdom of Saudi Arabia Ministry of Higher Education <b>Qassim University</b> College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
---	--	--

- **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 select the proper filter/amplifier,
  - The ability to design an accurate/sensitive signal conditioning systems that needs to be filtered or amplified or both
  - The ability to propose new conception for improving devices.
- 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
- 

***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**  
.....

**ii) Teaching strategies to be used to develop these skills-**  
.....

**iii) Methods of assessment of student's psychomotor skills**  
- .....

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

<p><b>Kingdom of Saudi Arabia</b>  Ministry of Higher Education  <b>Qassim University</b>  College of Engineering</p>		المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة
---	--	--

## 6- Learning Resources

- **Essential Books (References)**
- 1- Pozar: “Microwave Engineering”, 3rd Edition, John Wiley & Sons, Inc.
- 2- Guillermo Gonzalez, Microwave Transistor Amplifiers: Analysis and Design, Second Edition, Prentice Hall, ISBN: 0-13-254335-4
- 3- R. Ludwig, P. Bretchko, RF Circuit Design: Theory and Applications, Upper Saddle River, NJ: Prentice Hall,

**ii) Course Notes**  
- -----

**iii) Recommended Books**  
1- Pozar: “Microwave Engineering”, 3rd Edition, John Wiley & Sons, Inc.

**iv) Electronic Books & Web Sites:**  
- Course materials are uploaded on the College Web-Site ([www.qec.edu.sa](http://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- Commercial Software Advanced Design System “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   |
| iii) | Processes for Improvement of Teaching  |
| •    | Evaluation of the course outlines by external staff member from outside the university                                   |

<p><b>Kingdom of Saudi Arabia</b>  Ministry of Higher Education  <b>Qassim University</b>  College of Engineering</p>		<p>المملكة العربية السعودية  وزارة التعليم العالي  جامعة القصيم  كلية الهندسة</p>
---	--	---

<ul style="list-style-type: none"> <li>• Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.</li> </ul>
<p>iv) Processes for Verifying Standards of Student Achievement  It is planned to:</p> <ul style="list-style-type: none"> <li>• Check marking of a sample of student work by an independent faculty member.</li> <li>• Exchange periodically, and remark a sample of assignments with a faculty member in King Saud University (KSU).</li> </ul>
<p>v) The planning arrangements for periodically reviewing course effectiveness and planning for improvement.</p> <ul style="list-style-type: none"> <li>- 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),</li> <li>- Consequently, actions are to be taken to improve the course delivery when necessary.</li> <li>- Review of the course objectives, outcomes and curriculum each 2 years.</li> </ul>