



Course Syllabus: Microwave Circuits - EE 223

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 223
Course Title	Microwave Circuits
Academic Semester	Fall
Academic Year	2018/2019
Semester Start Date	08/26/2018
Semester End Date	12/11/2018
Class Schedule (Days & Time)	04:00 PM - 05:30 PM Sun Thu

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Atif Shamim	atif.shamim@kaust.edu.sa	+966128084507		Tuesday 2-4 pm in 3276 Building 3

Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	<p>The course objective is to understand and predict how an electric circuit behaves when its physical size is the same order of magnitude as the wavelength of excitation. The course helps understand how electromagnetic waves in the microwave regime can be guided through well-defined modes and how coupling, matching and filtering operations are key to efficient microwave systems. Theory and design of key microwave components (passives and active) will be studied. Probable topics are given below.</p> <ol style="list-style-type: none"> 1. Transmission lines Theory and Design (Microstrip line, Coplanar waveguide, etc) 2. Smith Chart and Impedance Matching (L-matching networks and stub matching) 3. Waveguides (Rectangular Waveguide, TE and TM modes) 4. Microwave Networks (Z-parameters, S-parameters, ABCD matrix) 5. Microwave System Level Fundamentals (Noise Figure, Dynamic Range, non-linearity) 6. Microwave Amplifier Design (Devices, Low Noise and Power Amplifier)
Course Description from Program Guide	<p>Fundamental microwave concepts: Transmission-line theory, guided wave propagation, S-parameters, ABCD matrix, signal-flow graphs, impedance and admittance transformation, matching networks, Smith chart. Microwave components: microstrip and coplanar lines, directional couplers, power dividers, low-pass and band-pass filters, diode detectors, microwave integrated circuits.</p>
Goals and Objectives	<p>By the end of this course students will have good understanding of microwave fundamentals and the know how of designing various kinds of transmission lines (such as microstrip, CPW, etc), impedance matching networks through Smith Chart, and amplifiers through S-parameters. They will also understand system level considerations for microwave designs such as noise figure, non-linearity, etc. Students will also learn industry standard simulation software Ansys HFSS and Agilent ADS which they will use for their design projects. Students will design either a passive component through simulations in HFSS or an active component in ADS simulator. At the end, they will write a report on this design project.</p>
Required Knowledge	Basic knowledge of electromagnetics and microwaves

Reference Texts	M. Pozar, Microwave Engineering, 3rd Edition Course Slides/Additional Handouts Additional Reference Books: Wentworth, Fundamentals of Electromagnetics with Engineering Applications Steer, Microwave and RF Design (A Systems Approach)
Method of evaluation	35.00% - Final exam 20.00% - Midterm exam 15.00% - Homework /Assignments 30.00% - Course Project(s)
Nature of the assignments	Numeric problems based 3 assignments will be given
Course Policies	For late submissions, students will have negative marking
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/26/2018 Thu 08/30/2018	Transmission Line Theory
2	Sun 09/02/2018 Thu 09/06/2018	Smith Chart
3	Sun 09/09/2018 Thu 09/13/2018	Impedance Matching
4	Sun 09/16/2018 Thu 09/20/2018	Practical Transmission Line Design
5	Sun 09/23/2018 Thu 09/27/2018	Waveguide Theory and Design
6	Sun 09/30/2018 Thu 10/04/2018	Microwave Networks (Z and Y parameters)
7	Sun 10/07/2018 Thu 10/11/2018	S-parameters, ABCD matrix
8	Sun 10/14/2018 Thu 10/18/2018	Introduction to HFSS and ADS Simulators
9	Sun 10/21/2018 Thu 10/25/2018	Microwave Filter Design
10	Sun 10/28/2018 Thu 11/01/2018	Midterm Exam and in Class Review
11	Sun 11/04/2018 Thu 11/08/2018	Microwave System Level Fundamentals (Noise Figure, etc)
12	Sun 11/11/2018 Thu 11/15/2018	Microwave System Level Fundamentals (Dynamic Range, non-linearity)
13	Sun 11/18/2018 Thu 11/22/2018	Fundamentals of Microwave Amplifier Design
14	Sun 11/25/2018 Thu 11/29/2018	Low Noise Amplifier Design
15	Sun 12/02/2018 Thu 12/06/2018	Power Amplifier Design
16	Sun 12/09/2018	Design Project in Class Presentations
17		Review Before Final Exam
18		

Note

The instructor reserves the right to make changes to this syllabus as necessary.