



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	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	01:00 PM - 02:30 PM Mon Thu

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

Teaching Assistant(s)	
Name	Email
TBA	TBA

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 project will be a simulations based design project
Course Policies	For late submissions, students will have negative marking
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 08/26/2019 Thu 08/29/2019	Transmission Line Theory
2	Mon 09/02/2019 Thu 09/05/2019	Smith Chart
3	Mon 09/09/2019 Thu 09/12/2019	Impedance Matching
4	Mon 09/16/2019 Thu 09/19/2019	Practical Transmission Line Design
5	Mon 09/23/2019 Thu 09/26/2019	Waveguide Theory and Design
6	Mon 09/30/2019 Thu 10/03/2019	Microwave Networks (Z and Y parameters)
7	Mon 10/07/2019 Thu 10/10/2019	S-parameters, ABCD matrix
8	Mon 10/14/2019 Thu 10/17/2019	Introduction to HFSS and ADS Simulators
9	Mon 10/21/2019 Thu 10/24/2019	Midterm Exam and in class Discussion
10	Mon 10/28/2019 Thu 10/31/2019	Microwave System Level Fundamentals (Noise Figure, etc)
11	Mon 11/04/2019 Thu 11/07/2019	Microwave System Level Fundamentals (Dynamic Range, non-linearity)
12	Mon 11/11/2019 Thu 11/14/2019	Fundamentals of Microwave Amplifier Design
13	Mon 11/18/2019 Thu 11/21/2019	Low Noise Amplifier Design
14	Mon 11/25/2019 Thu 11/28/2019	Power Amplifier Design
15	Mon 12/02/2019 Thu 12/05/2019	Design Project in Class Presentations
16	Mon 12/09/2019	Exams

Note

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