

**San José State University**  
**Electrical Engineering Department / College of Engineering**  
**EE172-01, Introduction to Microwave Engineering, Fall 2018**

**Course and Contact Information**

<b>Instructor:</b>	Dr. Ray Kwok
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<b>Office Hours:</b>	TuTh 10:15 – 11:15 am, or by appointment
<b>Class Days/Time:</b>	MW 6:00 - 7:15 pm
<b>Classroom:</b>	Dudley Moorhead Hall 160
<b>Prerequisites:</b>	Phys 52, Math 133A, EE140 (concurrent)

**Faculty Web Page and MYSJSU Messaging**

Course materials such as syllabus, handouts, notes, assignment instructions, etc., can be found on [Canvas Learning Management System course login website](http://sjsu.instructure.com) at <http://sjsu.instructure.com>. You are responsible for regularly checking with the messaging system through [MySJSU](http://my.sjsu.edu) at <http://my.sjsu.edu> (or other communication system as indicated by the instructor) to learn of any updates.

**Course Description**

This course is an introduction to Microwave Engineering. It covers the basic and practical approach to high frequency or high data-rate circuit design and applications. The course begins with the Transmission Line Theory, which is a practical engineering approach to electromagnetic wave problems. Impedance matching techniques, and design approach of selected microwave components such as coupler, power divider, attenuator, filter & antenna, will be presented. Emphasis will be on the fundamental principles and industrial practice of the designs. Commercial CAD tools such as AWR and HFSS will be introduced and provided. Students will also learn standard RF measurements, using waveguide resonator and antenna as examples.

**GE/SJSU Studies Learning Outcomes (GELO)**

Upon successful completion of this course, students will be able to:

GELO1 Demonstrate an understanding of the fundamentals of Electrical Engineering, including its mathematical and scientific principles, analysis and design.

GELO2 Demonstrate the ability to apply the practice of Engineering in real-world problems.

### **Course Content Learning Outcomes (LO)**

Upon successful completion of this course, students will be able to:

LO3 **Visualize** the abstract electromagnetic wave pattern and express it in terms of equivalent circuit. (a), (e), (k) & (n)

LO4 **Perform** circuit analysis using various mathematical models and techniques. (a), (b), (e), (k), (n) & (o)

LO5 **Read & Construct** standard microwave specifications for common devices. (b), (c), (d), (e), (g), (j), (k) & (l)

LO6 **Design** matching network for any device to maximize its performance in the system. (a), (b), (c), (e), (k), (l) & (o)

LO7 **Specify** the correct type of transmission line and dimensions needed for the specific system requirements. (a), (c), (e), (k), (l) & (o)

LO8 **Analyze** the resonant modes in transmission lines. (a), (c), (e), (k) & (l)

LO9 **Design** resonators for oscillator or filter applications. (a), (c), (d), (e), (g), (k) & (l)

LO10 **Design** simple passive microwave circuits with and without design CAD tools. (a), (c), (e), (k), (l) & (o)

LO11 **Acquire** basic but critical laboratory knowledge necessary for the understanding of theoretical and practical problems. (b), (f), (k), (l) & (o)

### **Required Texts/Readings**

#### **Textbook**

*Microwave Engineering*, David Pozar (Wiley & Sons), ISBN-13: **978-0470631553**

#### **Other Readings**

*Foundation for Microwave Engineering*, Robert E. Collin (McGraw-Hill)

*Fields and Waves in Communication Electronics*, Ramo, Whinnery & Van Duzer

*Fundamentals of Engineering Electromagnetics*, David K. Cheng (Addison-Wesley)

*Introduction to Electrodynamics*, David J. Griffiths (Prentice Hall)

### **Course Requirements and Assignments**

“Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practice. Other course structures will have equivalent workload expectations as described in the syllabus.”

Homework is crucial for understanding the course material. Homework will be assigned and graded regularly. Solutions will be provided. You're welcome (and encouraged) to discuss homework problems with other students in the class. Late homework after solution is published in Canvas would not be accepted.

*A tentative course calendar including exam dates is attached in the last page of this document, and published in Canvas. Schedule is subject to change with fair advance notice. Please visit Canvas for updates and communications.*

NOTE that [University policy F69-24](http://www.sjsu.edu/senate/docs/F69-24.pdf) at <http://www.sjsu.edu/senate/docs/F69-24.pdf> states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is essential to insure maximum benefit for all members of the class.

Homework will be assigned on Canvas. Some homework problems require the use of a computer to perform simulations. Commercial software is available to be downloaded in student's laptop computer. In addition, Computer Lab is also available for students if needed. Details will be discussed in class.

### **Final Examination or Evaluation**

There will be two midterm exams and a final exam. Exams cover the assigned reading materials and class lecture notes. There will be no make-up exams (only in very special circumstances, both written excuse and official proofs are required for extraordinary exams). Mid-term Exam solutions will be discussed in class after the exam dates and posted in Canvas.

The Final Exam will be cumulative on all the topics covered throughout the semester. Final Examination will be scheduled according to the SJSU Final Examination Schedule. "Faculty members are required to have a culminating activity for their courses, which can include a final examination, a final research paper or project, a final creative work or performance, a final portfolio of work, or other appropriate assignment." More details can be found in University policy S17-1 (<http://www.sjsu.edu/senate/docs/S17-1.pdf>).

### **Grading Policy**

Assignments :	5%
Midterm Exam #1:	25%
Midterm Exam #2:	25%
Final Project and Exam:	45%
Letter Grade:	$A \geq 80\%$ , $65 \leq B < 80\%$ , $50 \leq C < 65\%$ , $35 \leq D < 50\%$ , $F < 35\%$

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See [University Policy F13-1](http://www.sjsu.edu/senate/docs/F13-1.pdf) at <http://www.sjsu.edu/senate/docs/F13-1.pdf> for more details.

## Classroom Protocol

*Active participation in class is essential to learn and understand any complex scientific and engineering concepts. Advanced electronic devices are allowed as long as they are used according to the lessons plan. This included laptop computers for simulation, tablets for note-taking, and calculators for exercises. No mp3 players and cell phones used in class.*

## Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at [http://www.sjsu.edu/provost/services/academic\\_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

## University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>"

## EE172-01, Introduction to Microwave Engineering, Fall 2018 Course Schedule

*Schedule is subject to change with fair notice. Please check Canvas frequently.  
Homework assignment, solution, sample exams along with lecture slides will be published in Canvas.*

### Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	8/22	Transmission Line Theory
1	8/27	Transmission Line Theory
2	8/29	Equivalent Circuits
2	9/3	Labor Day
3	9/5	Voltage & Current Waves
3	9/10	Impedance Matching
4	9/12	Single & Double Stub Tuning

<b>Week</b>	<b>Date</b>	<b>Topics, Readings, Assignments, Deadlines</b>
4	9/17	Smith Chart
5	9/19	Z-Y Chart
5	9/24	CAD Tool - Microwave Office
6	9/26	Review
6	10/1	Mid-Term 1
7	10/3	Microwave Matrices
7	10/8	ABCD Matrices
8	10/10	S parameters
8	10/15	N-port network
9	10/17	Waveguide modes
9	10/22	Resonators
10	10/24	CAD: AWR
10	10/29	CAD: HFSS
11	10/31	Review
11	11/5	Mid-Term 2
12	11/7	1-port network: Wideband termination
12	11/12	1-port network: Antennas
13	11/14	Phase-array antennas
13	11/19	2-port network: Transformers
14	11/21	2-port network: Filters
14	11/26	Microwave Filters
15	11/28	3-port network: Power dividers
15	12/3	4-port network: Couplers
16	12/5	RF measurements
16	12/10	Review
Final Exam	12/12	Wed 5:15 – 7:30 pm