San José State University  
College of Engineering / Electrical Engineering Department  
EE172-01, Introduction to Microwave Engineering, Spring 2021

Course and Contact Information

Instructor: Dr. Ray Kwok  
Office Location: ENG 351  
Telephone: (408) 924-3950  
Email: Raymond.Kwok@sjsu.edu  
Office Hours: MW 10:15 – 11:00 am (Zoom) + appointment  
Class Days/Time: MW 9:00 - 10:15 am  
Classroom: Online - Zoom  
Prerequisites: Phys 52, Math 133A, EE140 (concurrent)

Course Description

This course is an introduction to RF (Radio Frequency) and 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.

Course Format

Technology Intensive, and Online Courses

All lectures are conducted online this semester. You will need a stable WiFi connection as well as a computer to access all the information, submit your work including examinations. If you need assistance in this area, lease seek help through student services.

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on Canvas Learning Management System course login website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through MySJSU on Spartan App Portal http://one.sjsu.edu to learn of any updates.

Use of Camera in Class
Please have a camera and be ready to use it during class. Although it is not mandatory to have the camera on during lecture time, it is required to have it on during quizzes, and examinations. When asking or answering a question during class, I would encourage, although not required, students to turn on the camera so that we can still experience the person-to-person interaction which is often missed in online courses.

**Technology Requirements**

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students. A digital pen or digital pad is very useful during online discussion. Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor, as soon as possible or at the latest one week before the test date to determine an alternative. See Learn Anywhere website for current Wi-Fi options on campus.

**Zoom Classroom Etiquette**

- Mute Your Microphone: To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- Be Mindful of Background Noise and Distractions: Find a quiet place to “attend” class, to the greatest extent possible.
- Avoid video setups where people may be walking behind you, people talking/making noise, etc.
- Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- Position Your Camera Properly: Be sure your webcam is in a stable position and focused at eye level.
- Limit Your Distractions/Avoid Multitasking: You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- Use Appropriate Virtual Backgrounds: If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

**Recording of Zoom Classes**

Lectures will be recorded and the link will be share on Canvas. This is very helpful for students who want to go over the lecture again to capture something they might have missed the first time. However, this should not replace the real time lecturing in which you have the opportunity to ask questions right away, and a chance to interact with other students. To make sure you would attend lectures, a daily short quiz will be given.

Students are not allowed to record without instructor permission. Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor. Other Information to provide to Students: Technology Requirements (example) Students are required to have an electronic device (laptop, desktop o

**GE Learning Outcomes (GELO)**

Upon successful completion of this GE course, students will be able to:
1. GELO1  Demonstrate an understanding of the fundamentals of Electrical Engineering, including its mathematical and scientific principles, analysis and design.
2. GELO2  Demonstrate the ability to apply the practice of Engineering in real-world problems.

Course Learning Outcomes (CLO)
Upon successful completion of this course, students will be able to:

1. CLO1 Visualize the abstract electromagnetic wave pattern and express it in terms of equivalent circuit.
2. CLO2 Perform circuit analysis using various mathematical models and techniques.
3. CLO3 Read & Construct standard microwave specifications for common devices.
4. CLO4 Design matching network for any device to maximize its performance in the system.
5. CLO5 Specify the correct type of transmission line and dimensions needed for the specific system requirements.
6. CLO6 Analyze the resonant modes in transmission lines.
7. CLO7 Design simple passive microwave circuits with and without design CAD tools.
8. CLO8 Acquire basic but critical laboratory knowledge necessary for the understanding of theoretical and practical problems.

Required Texts/Readings

Textbook


Other Readings

*Foundation for Microwave Engineering*, Robert E. Colin (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 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 and a final exam. Examinations emphasize on understanding of the materials covered in class and lectures. 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 Information**

Grades from homework, quizzes, and examinations are constantly updated on Canvas. Students are expected to keep track of their progress in class frequently and seek help early as needed. Please come to my office to discuss your class performance should you have any concern at any time.

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 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

**Determination of Grades**

- Assignments : 5%
- Midterm Exam #1 : 25%
- Midterm Exam #2 : 25%
Final Project: 45%

Letter Grade:

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<tr>
<th>Grade</th>
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<tbody>
<tr>
<td>A</td>
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<td>D</td>
<td>35 to 49.9%</td>
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<tr>
<td>F</td>
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Please visit [https://www.sjsu.edu/registrar/academic-records/grade-changes.php](https://www.sjsu.edu/registrar/academic-records/grade-changes.php) for the Spring 2021 Special University Grading Policy.

Classroom Protocol

Active participation in class is essential to learn and understand any complex scientific and engineering concepts. No electronic devices are not allowed in class, including laptop computers, tablets, mp3 players, or cell phones. Only simple single-line calculators are allowed during examinations.

University Policies

Per [University Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at [http://www.sjsu.edu/gup/syllabusinfo/](http://www.sjsu.edu/gup/syllabusinfo/). Make sure to visit this page, review and be familiar with these university policies and resources.

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 section at [http://info.sjsu.edu/static/catalog/policies.html](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 at [http://www.sjsu.edu/provost/services/academic_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The Late Drop Policy is available at [http://www.sjsu.edu/aars/policies/latedrops/policy/](http://www.sjsu.edu/aars/policies/latedrops/policy/). Students should be aware of the current deadlines and penalties for dropping classes.

EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor.”

Measures Dealing with Occurrences of Cheating
- Department policy mandates that the student or students involved in cheating will receive an “F” on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.
- A student’s second offense in any course will result in a Department recommendation of suspension from the University.
## EE172-01, Introduction to Microwave Engineering
### Spring 2021 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

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics, Readings, Assignments, Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/27</td>
<td>Class Organization</td>
</tr>
<tr>
<td>1</td>
<td>2/1</td>
<td>Transmission Line Theory</td>
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<tr>
<td>2</td>
<td>2/3</td>
<td>Transmission Line Theory</td>
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<tr>
<td>2</td>
<td>2/8</td>
<td>Equivalent Circuits</td>
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<tr>
<td>3</td>
<td>2/10</td>
<td>Voltage &amp; Current Waves</td>
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<tr>
<td>3</td>
<td>2/15</td>
<td>Impedance Matching</td>
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<tr>
<td>4</td>
<td>2/17</td>
<td>Impedance Matching</td>
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<td>4</td>
<td>2/22</td>
<td>Single &amp; Double Stub Tuning</td>
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<td>5</td>
<td>2/24</td>
<td>Smith Chart</td>
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<tr>
<td>5</td>
<td>3/1</td>
<td>Z-Y Chart</td>
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<td>6</td>
<td>3/3</td>
<td>CAD Tool - Microwave Office</td>
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<tr>
<td>6</td>
<td>3/8</td>
<td>Review</td>
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<tr>
<td>7</td>
<td>3/10</td>
<td>Mid-Term 1</td>
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<tr>
<td>7</td>
<td>3/15</td>
<td>Microwave Matrices</td>
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<tr>
<td>8</td>
<td>3/17</td>
<td>ABCD Matrices</td>
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<tr>
<td>8</td>
<td>3/22</td>
<td>S parameters</td>
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<tr>
<td>9</td>
<td>3/24</td>
<td>N-port network</td>
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<td>9</td>
<td>4/5</td>
<td>Waveguide modes</td>
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<tr>
<td>10</td>
<td>4/7</td>
<td>Resonators</td>
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<tr>
<td>10</td>
<td>4/12</td>
<td>CAD: HFSS</td>
</tr>
<tr>
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<td>4/14</td>
<td>Review</td>
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<td>4/19</td>
<td>Mid-Term 2</td>
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<td>12</td>
<td>4/21</td>
<td>1-port network: Antennas</td>
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<tr>
<td>12</td>
<td>4/26</td>
<td>Phase-array antennas</td>
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<tr>
<td>Week</td>
<td>Date</td>
<td>Topics, Readings, Assignments, Deadlines</td>
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<tr>
<td>13</td>
<td>4/28</td>
<td>2-port network: Transformers</td>
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<tr>
<td>13</td>
<td>5/3</td>
<td>2-port network: Filters / Couplers</td>
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<tr>
<td>14</td>
<td>5/5</td>
<td>3-port network: Power Dividers</td>
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<tr>
<td>14</td>
<td>5/10</td>
<td>Final Review</td>
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<tr>
<td>Final Exam</td>
<td>5/19</td>
<td>7:15 – 9:30 am, Wed</td>
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