San José State University
Department of Electrical Engineering
EE 160-02, Principles of Communication Systems Laboratory, Fall 2019

Course and Contact Information
Instructor: Robert Morelos-Zaragoza
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Email: robert.morelos-zaragoza@sjsu.edu
Office Hours: Tuesdays 14:00-15:00 and Wednesdays/Fridays 15:00-16:00
Class Days/Time: Monday 15:00 – 17:45
Classroom: ENG 238 (RF Communications Laboratory)
Prerequisites: EE 112

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 at http://sjsu.instructure.com

Course Description
Introduction to communication systems. Harmonics analysis of amplifiers and amplitude modulators. Sampling and its applications to frequency shifting for wireless transmission. Communication receiver architectures: Direct-conversion and heterodyne. Amplitude modulators and demodulators: Up-conversion and down-conversion techniques. Introduction to basic binary modulation techniques: ASK, OOK and FSK. This laboratory is designed to provide the student with practical demonstrations of the fundamental principles of analog and digital communication systems. The laboratory starts with learning to use the spectrum analyzer. Simple electronic circuits are then used to demonstrate the sampling theorem, amplitude modulation (AM), binary modulation (OOK, ASK and FSK) and power measurements. Each experiment is allocated one or two lab periods (weeks). Students are required to read completely and understand the experiment’s description and material used, and to complete a set of pre-lab calculations. Some of the pre-lab and post-lab calculations require the use of the Matlab software, which is available in the lab computers.

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

1. Demonstrate an understanding of the fundamentals of Electrical Engineering, including its mathematical and scientific principles, analysis and design.
2. Demonstrate the ability to apply the practice of Engineering in real-world problems.

Departmental Course Learning Outcomes
Upon successful completion of this course, students will be able to:
LO3 Analyze signals used in communication systems (1)
LO4 Compare components and subsystems used in communication systems (2)
LO5 Perform laboratory based operational and measurement criteria for analog and digital communication systems in both time and frequency domains (6)
LO6 Critically assess the predicted and measured performance of communications systems (2)
LO7 Demonstrate the process of spectral translation (downconversion and upconversion) via narrowband signal analysis and filtering (1)
LO8 Understand the complexity interplay in communication systems, in terms of circuit and component requirements (2)
LO9 Interpret and report on computer-based performance predictions compared to measurements of analog and digital (binary) modulation techniques (2)
LO10 Understand the impact of noise on communication system performance (1)

**ABET outcomes**

The letters in parentheses in each of the course learning outcomes above refer to ABET (Accreditation Board for Engineering and Technology) student outcomes satisfied. These are listed below as a reference:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

**Required Texts/Readings**

**Textbook**

EE 160 laboratory manual and notes (Available in Canvas)

**Course Requirements and Assignments**

Based upon the course enrollment and the number of laboratory stations that are available and functioning, students will be divided into laboratory groups for the experiments. Each student is expected to actively participate in performing each one of the experiments.

Students who have performed the experiment together may submit either individual reports or a single joint report. A student who does not work with the group must submit an individual report. Every student must complete every laboratory assignment in order to receive a grade in the course. Reports are due on the day of the subsequent experiment.
“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 practica. Other course structures will have equivalent workload expectations as described in the syllabus.”

**Final Examination or Evaluation**

**Grading Information**

**Grading policy**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-lab calculations</td>
<td>25%</td>
</tr>
<tr>
<td>Report</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Classroom Protocol**

Students are expected to participate actively in class. Students will turn their cell phones off or put them on vibrate mode while in class.

**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.

**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](http://www.sjsu.edu/gup/syllabusinfo/”). Make sure to visit this page, review and be familiar with these university policies and resources.
EE160, Principles of Communication Systems, Fall 2019, Lab Schedule

*NOTE: This schedule is subject to change with fair notice as announced in the laboratory*

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Dates</th>
<th>Topic</th>
<th>CLOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9/9, 9/16, 9/23</td>
<td>Harmonics, distortion and two-tone test (Three sessions)</td>
<td>LO3-LO5, LO10</td>
</tr>
<tr>
<td>2</td>
<td>9/30, 10/7, 10/14</td>
<td>Spectra of periodic and sampled signals (Three sessions)</td>
<td>LO3-LO5, LO7</td>
</tr>
<tr>
<td>3</td>
<td>10/21, 10/28</td>
<td>Amplitude modulation: Up-conversion (Two sessions)</td>
<td>LO5-LO6, LO8</td>
</tr>
<tr>
<td>4</td>
<td>11/4, 11/11</td>
<td>Amplitude demodulation: Down-conversion (Two sessions)</td>
<td>LO5-LO6, LO8</td>
</tr>
<tr>
<td>5</td>
<td>12/2</td>
<td>Wireless digital transmission and power spectral density (One session)</td>
<td>LO6-7, LO9-10</td>
</tr>
<tr>
<td>6</td>
<td>12/8</td>
<td>Wireless digital reception and power measurement (One session)</td>
<td>LO9-10</td>
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