Course Description:
Laboratory, 3 hours (1 unit). Laboratory work covers various analog and digital communication elements as well as modulation and demodulation techniques.

Prerequisites: ES 230 and ES 400, or consent of instructor.
Co-requisite EE 442, or consent of instructor

Instructor: Wei L Lin

Phone: (707) 577-1940  E-mail: weiliang.lin@sonoma.edu

Electronic manuals will be provided.

Tentative Outline of Course:

No class: 3/22/19 during Spring Break, 4/5/19, 4/12/19 during Midterm, 5/17/19 during Finals

1/25        Introduction to the course
2/1 and 2/8  Lab 1 (3-1): Percent Modulation
2/15        Lab 2 (4-1): Diode Mod & Mixer
2/22        Lab 3 (4-3): Diode Detector
3/1         Lab 4 (5-1): FM
3/8         Lab 5 (6-1): PLLs
3/15 and 3/29  Lab 6 (6-3): PLL demodulation
4/19        Lab 7 (8-1): Class C Amp & Frequency Multipliers
4/26        Lab 8 (9-1): Noise measurements
5/3         Lab 9 (11-2): Freq. shift keying
5/10        TBD

For up-to-date information regarding this course, please be sure to check your email frequently. Some lab topics might be changed during the semester, but it will be announced at least one week ahead the lab.
Grading information:
Attendance and participation is mandatory!
If you are 15 mins late after the class starts, you will loss the credit from class participation. So, please make sure be on time!

The lab time is mainly used for doing the measurement. Please make sure bring your pre-lab circuit and should mainly spend time for doing the measurement and showing the demo in class. You need work in teams of two people. The first class will determine each team and it is not allowed to change team partner after it. As a team, each group need show me the circuit is working before each of you can get credit for that lab. Be sure I check off your name for that lab after you’ve shown me it is working in the class.

<table>
<thead>
<tr>
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<th>Percentage</th>
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<tbody>
<tr>
<td>In-Class Lab Demo</td>
<td>50%</td>
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<tr>
<td>Pre-Lab Circuit</td>
<td>15%</td>
</tr>
<tr>
<td>Class Participation</td>
<td>15%</td>
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<tr>
<td>Lab Reports</td>
<td>20%</td>
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Lab write-ups must be emailed to me prior to the beginning of the next lab. Lab write-ups must also be printed and placed in the acrylic bin in the department office. Both lab write-ups electronic and printed versions are required in order to get the lab report credit and they must be sent out and placed in the acrylic bin prior to the beginning of the next lab per person.

Note: It is your responsibility to make sure the grader has received, graded, and entered your grades correctly.

Incomplete assignments are not accepted.

CONDUCT: In order to create an appropriate environment for teaching and learning, students must show respect for their instructor and fellow students. Listed below are a few guidelines for classroom behavior. Students are expected to follow these rules to ensure that the learning environment is not compromised.

1. Class Participation: You are expected to be in class the entire class time. Please do not enter late or leave early unless you finish the demo early. Rare exceptions may be made, particularly in emergency situations. Your participation in the class and lab are very important and the lab time should be mainly used for doing the measurement. It is required the pre-lab circuit need to be completed before the class starts.

2. Absences: Attendance and participation is mandatory. Also, take responsibility for working with your partner to complete work you missed. Your Instructor is not responsible for your absence or being late, so it would be to your advantage to find out what you missed from other students or your partner.
3. Conversation: Do not have side conversations in class. Stay focused on finishing the lab in as short a time as is practical. Don’t carry on conversations with people outside the class (i.e. No texting, phone, or email with others). Check your texts and emails before coming to class!

4. Do not sleep or daydream. Stay focused on learning and completing the tasks at hand.

5. No Internet browsing: Listen for instructions, information, lectures, and advice at all times in the lab. Avoid all other distractions.

6. Attitude: You are expected to maintain a civil attitude in class. You may not use inappropriate or offensive commentary or body language toward the instructor or fellow students.

7. Cell phones: You may not use your cell phone during class. Please turn off your cell phone upon entering the classroom.

PLAGIARISM: All forms of cheating and plagiarism are serious offenses that can result in disciplinary penalties including expulsion from the university. This includes copying assignments from the Internet! Refer to the student handbook for details.

WITHDRAWAL: No student will be granted a withdrawal after the deadline unless under extreme circumstances. Policy regarding withdrawal is stated in the university catalog.

SPECIAL NEEDS: Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs.

Study Guidelines: In order to get the most out of this course, always try to stay ahead. Make sure you have reviewed the material in advance so the following labs will be more informative and meaningful.

Course Outcomes (COs):

1. Know how to recognize, debug, design, and use circuits involving modulation and demodulation.

2. Know how to design, build and test modulation and demodulation circuits.

3. Perform group lab experiments relating to modulation and demodulation circuits.

Course Learning Objectives (CLOs):

A. Explain the differences between analog and digital communication systems; compare their respective advantages and disadvantages.
B. Understand signal multiplexing, modulation and demodulation; bandwidth requirements; signal power requirements for both analog and digital communication systems; etc.

C. Apply signal and system analytical tools in both the time and frequency domains; including Fourier transforms frequency response, time duration versus bandwidth tradeoffs, impulse response and convolution, etc.

D. Understand analog modulation and demodulation, in particular, amplitude, phase and frequency modulation and demodulation.

E. Application of the Sampling theorem to analog-to-digital conversion and understand the limitations of practical sampling, quantization and encoding.

F. Develop critical thinking skills by analyzing communication systems through associated laboratory activities.

Student Learning Outcomes vs. Course Learning Objectives:

(Support Level (0-5) 0=No support, 1=lowest support, 5=highest support)

<table>
<thead>
<tr>
<th>ABET Student Outcomes</th>
<th>Course Learning</th>
<th>Level of Support</th>
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<tbody>
<tr>
<td>Course Learning</td>
<td>Objectives</td>
<td></td>
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<tr>
<td>(a) an ability to apply knowledge of mathematics, science, and engineering</td>
<td>A,B,C,D,E,F</td>
<td>4</td>
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<tr>
<td>(b) an ability to design and conduct experiments, as well as to analyze and interpret data</td>
<td>H</td>
<td>4</td>
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<td>(c) an ability to design a system, component, or process to meet desired needs</td>
<td>A,B,C,D,E,F</td>
<td>4</td>
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<td>(d) an ability to function on multi-disciplinary teams</td>
<td>A,B,C,D,E,F</td>
<td>4</td>
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<td>(e) an ability to identify, formulate, and solve engineering problems</td>
<td>A,B,C,D,E,F</td>
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<td>(f) an understanding of professional and ethical responsibility</td>
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<td>(g) an ability to communicate effectively</td>
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<td>(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context</td>
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<td>(i) a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>(j) a knowledge of contemporary issues</td>
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<tr>
<td>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
<td>A,B,C,D,E,F</td>
<td>4</td>
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