PURDUE
UNIVERSITY

SCHOOL OF ELECTRICAL
AND COMPUTER ENGINEERING
UNDERGRADUATE COUNSELING OFFICE

To: The Engineering Faculty
From: School of Electrical and Computer Engineering
Re: ECE 20008

The School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 20008 Electrical Engineering Fundamentals II Lab
Lecture: 1 credit
Semesters offered: Fall, Spring
Non-repeatable

Pre-requisites: ECE 20007 and ECE 20002 [may be taken concurrently].

Course Description
This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project. In many ways this course is the laboratory of the co-requisite lecture course ECE 20002 Electrical Engineering Fundamentals II; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

Reason
Content from current ECE 20100, 20200 and 25500 has been evaluated and redistributed into two new courses (ECE 20001 and ECE 20002) that will replace these three aforementioned courses. ECE 20800 was the lab for ECE 25500, thus this is the new version of the lab that goes with the new ECE 20002 course. Please see syllabus (currently being taught as a variable title experimental course ECE 29595).

History of Previous Offering
This course has run as an experimental course for two semesters.

Michael R. Melloch, Associate Department Head of ECE

465 Northwestern Avenue · West Lafayette, IN 47907-2035 USA
Phone: (765)494-3390 · FAX: (765)494-3393 · E-mail: *eceugo@ecn.purdue.edu*

ECE 29595: Electronic Measurement Techniques II

Spring 2019

1 Course Overview

This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in a two week group design project.

In many ways this course is the laboratory of the co-requisite lecture course ECE Fund. 2; however, we remind students that this is a standalone course that expects students will learn and demonstrate material not taught in other courses.

1.1 Course Objectives

A student who successfully fulfills the course requirements will be able to:

1. Competently select, use, and automate electronic measurement instruments.
2. Design, wire, and troubleshoot electronic circuits.
3. Simulate electronic circuits.
4. Design, build, and test resistor-inductor-capacitor, operational amplifier, etc. circuits to meet specifications.
5. Demonstrate knowledge of laboratory safety precautions.
6. Maintain laboratory notes and create professional experiment reports.
7. Demonstrate an ability to function on a team that draws on from a diverse background.

1.2 Course Schedule

Note: We reserve the right to modify the experiment order and topic. Any change will be announced via Blackboard and with sufficient time to complete the prelab and prepare for class.

Session	Experiment	Prelab	Report	Exam / Project	Formal report
1	The Inverter		✗		
2	Motor Control	✗	✗		
3	Operational Amplifier Circuits	✗	✗		
4	FET Curve Tracer	✗	✗		
5	Common Source Amplifier	✗	✗		
6	Differential Amplifier	✗	✗		
7	MOSFET Operational Amplifier	✗	✗		
8	Operational amplifier characterization	✗	✗		
9	Lab practical			✗	
10	RLC step response	✗	✗		
11	Switching: DC voltage regulation	✗	✗		
12	Active Filters	✗	✗		
13	Power Amplifiers	✗	✗		
14	Final project: Audio amplifier	✗[1]			
15				✗[2]	✗[3]

Table 1: Course schedule by session number.

[1] Due session 14, as normal.
[2] Due session 15, a live demonstration of design.
[3] Due three days after session 15, individual work.

1.3 Grade breakdown

Reports:	50%
Prelabs:	20%
Lab practical:	10%
Project demo:	10%
Formal report:	10%

2 Course Policies

The section graduate teaching assistant (GTA) is your instructor and is responsible for assessing the quality of your work and progress in the course. Ultimately they are responsible for determining your semester grade.

To receive a **passing** grade, you must *at least*:

1. Attend and perform all experiments during your **scheduled lab time**. A student should request an excused absence from the TA **before** the scheduled sessions begins.
2. Submit a **complete** report for all experiments with a report due.
3. Submit a **complete** formal report.
4. Attend all scheduled lab sections (unless excused by the TA).
5. Obtain an average of 60% or better on the lab practical and project exams.
6. Work with your partner(s) during the lab period.

2.1 Due dates and attendance

1. Attendance and full participation is **required** for this course to receive a passing grade. The lab session is group work, and it is unfair to your partner if you are not present and working.
    a) If an unexpected or unexcused absence occurs, notify your GTA immediately to workout a makeup plan.

b) The TA reserves the right to apply a 50% grade deduction on any work submitted for a lab session that was not attended. Particularly, if occurring frequently.

c) The TA reserves the right to apply a 50% grade deduction on any work submitted for a lab session that was left early without TA approval. Particularly, if occurring frequently.

2. Prelabs are due at the start of class. No prelabs will be accepted after the TA has picked them up.

3. Lab reports are due at the start of class. Labs turned in late will have the total grade deducted by 20% for each day late (excluding weekends and days that Purdue is not in session). Lab reports turned in after the TA has picked them up will be considered one day late.

4. Project demos will occur in lab session 15. No late demos will be accepted.

2.2 Lab access

You will have 24/7 access to the lab. This access is a privilege and can be revoked. You **may not work alone**. If the lab is not busy, you are free to allow a person not in the course to **sit with you** while you complete your tasks. Otherwise, you may not allow anyone else to use the lab for any reason. Please cleanup after yourself, report damaged or lost equipment, and **do not remove anything**. There are cameras in the labs and we will review them in case of an incident.

2.3 Regrades

Regrades must be requested within one week of receiving graded work. We reserve the right to deny a regrade request made after this time.

2.4 Cheating

1. You are expected to behave professionally and ethically in this class. As such, all of Purdue's rules regarding academic dishonesty, cheating, and plagiarism will be enforced.

2. All work you submit must be your own original work. You may only submit the same plots and data as your lab partner **if you worked together when generating them**.

3. Copying (even if you change a few words) the text from your lab partner or the lab manual is considered cheating.
4. You may not use material, data, results, or any items from work done by current or past students, regardless of how you came across those materials.
5. All cases of cheating will results in a grade of 0 on the assignment. Repeated offenses may result in failing the course. Cheating will also result in a report to the office of the dean of students.

2.5 Changes to course

In the event of a major campus emergency, course requirements, deadlines, and grading percentages are subject to change. You will receive any changes to the course via announcements from your TA, announcements posted to blackboard, and/or emails sent to the course mailing list.

2.6 Questions or issues with the course

If you are in doubt about any section of this syllabus or the grading of the course, ask your TA. If you are dissatisfied with any aspect of the content or teaching of this course, please inform your TA. You may also contact the course coordinator Andrew Balmos (abalmos@purdue.edu).

3 Required Materials

By the Saturday following lab session 1, you will need:

1. The draft lab manual will be made available on the course website, `https://engineering.pur`
2. The laboratory kit is available at `http://www.elexp.com/purdue.aspx`. Purchase the **master** kit if you do not already have it.

   For in-lab (lab 2) delivery and free shipping:

   a) Order before the Saturday following lab session 1,

   b) use promo code 'PRDSUM' at checkout,

   c) use the shipping address: `465 Northwestern Ave, West Lafayette, IN 47907`

Any kit purchased after the deadline will be shipped directly to the student with a shipping charge. Do not use the above shipping address but rather use an address that you can accept mail at.

Kits can be shared during experiments, but everyone **MUST** have their own kit for the lab practical.

4 Safety

There are several dangers that can be encountered in an electrical laboratory. These include (but are not limited to):

1. Shock, typically caused by higher voltage but may occur at any voltage
2. Burns (from soldering irons or hot components)
3. Mechanical injury (from motors and other electromechanical motion devices)
4. Chemical exposure (solder contains lead)

Be aware of these potential dangers and make every effort to avoid them. If you find anything unsafe, exposed wires, sharp edges, unbalanced equipment, etc. please report them to your TA and/or lab staff in EE 162 (ECE Shop) immediately. Do not use the associated equipment and bench.

4.1 In case of accident

Emergency Situations

1. Using the phone in the lab, dial 911.
2. Send a person to each entrance to the building to guide emergency personnel back to the lab.
3. Immediately notify your TA and/or lab staff in EE 162 (ECE Shop).
4. Assist injured in any way appropriate.

All other accidents.

1. Immediately notify your TA and/or lab staff in EE 162 (ECE Shop).

2. Assist injured in any way appropriate.

5 Course Expectations

5.1 Lab Notebooks

Your lab notebook should be a log of all your work performed in this course. It should be written and/or typed in **real time** as the lab is completed.

The ability to keep good logs is incredibly important. In industry, the lab notebook is often the primary document used to defend patents.

The lab notebook should answer the following:

1. What are you doing (Objective)
2. How are you doing it (Procedure)
3. What are the facts (Results)
4. What can we take away from this experiment (Conclusions)
5. What is a summary of what was done? (Abstract)

Keeping a well organized and neat lab notebook is essential to success in this course and will improve your effectiveness in future laboratory environments.

5.2 Preparing for class

Preparing for class is essential to your success in ECE 29595-2, as the experiments are challenging and often require the full scheduled session to complete. You are expected to read the lab manual and answer all prelab questions in your notebook before lab. If you don't, you will likely not finish some experiments. Some experiments have accompanying video material which may have a graded quiz that contributes to your prelab grade.

5.3 In class

During lab, you should perform each task of the experiment, recording your work in your lab notebook **as you proceed**. Your lab manual is proof that you performed the experiments.

You are expected to remain in class for the **full scheduled period**. You may only leave if you have turned in your lab report from that week. A 50% grade deduction may be applied to the lab report of students who leave early without TA approval.

If you do not finish the lab in class, you must complete it before the beginning of the next week's lab.

5.4 After Class

After performing the experiments and gathering results, you will need to analyze the results and draw conclusions. Analysis may require loading data into a tools such as Python Numpy, MATLAB, etc. to make plots and compare results. Analysis and conclusions should be well founded in fact and measurements. "The experiment worked well" or "The resistor resisted as expected" are not acceptable conclusions.

Your analysis should always compare theoretical calculations with measured results and attempt to measure and describe the causes for error.

5.5 Individual and group work

Prelab

The prelabs are individual work. You may work with others to formalize a strategy to solving the problems, but you must solve them on your own. Any collusion, copying, or borrowing with be considered academic dishonesty. This includes works done by students in past semesters.

Report

The reports are a combination of group and individual work. Data and results collected in lab and office hours completing the given tasks is considered group work and can be shared **as long as everyone was present and actively completing the task**. A group is two to three students. Everything except the data and results sections of the report is individual work. You must only submit your own work. Any collusion with, copying from, or borrowing from others is considered academic dishonesty. This includes works done by students in past semesters.

Lab practical

The practical exam is **closed book**. The exam problems are included in your lab manual. On the day of the exam, your TA will provide the necessary values to complete

the problems. We **strongly** encourage you to make up some example values and practice the exam in open lab.

Project and formal report

In terms of the individual vs group efforts, the project and formal report is handled the same as a standard lab and report. The demonstration score is a group score.

6 Purdue honor pledge

Purdue's Honor Pledge was developed by students to advance a supportive environment that promotes academic integrity and excellence. It is intended that this pledge inspires Boilermakers of all generations to stay "on track" to themselves and their University. We encourage you to make this pledge. The pledge is:

> As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.

You may find more information at `https://www.purdue.edu/provost/teachinglearning/honor-pl`

7 CAPS

CAPS Information: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and `http://www.purdue.edu/caps/` during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

8 Non discrimination

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes

that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue's nondiscrimination policy can be found at: `http://www.purdue.edu/purdue/ea_eou_statement.html`.

9 Students with documented disabilities

The Disability Resource Center (DRC) is a resource for students and instructors. Students may present a "Letter of Accommodation" at any point in the semester. Should you have questions about accommodations, please contact the DRC at: 494-1247 or drc@purdue.edu. In many cases the DRC can partner with you to develop inclusive teaching strategies that benefit all students in your class

10 Academic integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

11 Campus emergencies

In the event of a major campus emergency, course requirements, deadlines, and grade weights are subject to change. In case of such an event, information will be provided via Blackboard and email.