Syllabus

Engineering/Physics Department
EE283 Electrical Measurements Lab

Instructor: Dr. Shi Sha (Sections F, G and I)
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Instructor: Dr. John Gilmer (Sections C and D)
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Instructor: Mr. William Schlosser (Section B)
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Office: SLC-271
Office Hours: By Appointment

Textbook: None Required

Credits: One Credit

Lab Time and Location: One 1 hour 50 Minute lab. SLC-193

Section	Day	Time
B	Thursday	1:00 to 2:50 p.m.
C	Thursday	3:00 to 4:50 p.m.
D	Friday	9:00 to 10:50 a.m.
F	Friday	1:00 to 2:50 p.m.
G	Friday	11:00 a.m. to 12:50 p.m.
I	Friday	3:00 to 4:50 p.m.

Co-Requisites: EE211 Electrical Circuits and Devices

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EE 283 Electrical Measurements Lab Fall, 2019

Objectives: The formal objectives of EE 283, Electrical Measurements Lab, are that the students will:

1. Develop competency in the use of common electrical measurement instrumentation.
2. Be able to construct circuits as represented on a circuit diagram.
3. Use common methods of signal conditioning.
4. Document laboratory activities and observations and analyze laboratory data.
5. Construct and analyze (troubleshoot) model engineering systems (projects).
6. Use simulation (either LTSpice or PSpice) for circuit analysis.

Assessment Rubrics: The assessment rubrics of EE 283, Electrical Measurements Lab, are that the students will have an ability to:

1. Identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics.
2. 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. Communicate effectively with a range of audiences.
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed using appropriate learning strategies,

Reading Assignments: Students are expected to read the assigned lab exercise by the assigned class period. Failure to prepare for the lab will result in a failure to complete the lab during the lab period.

Computer Use: Students are expected to use computers to do analyses and to prepare reports, Computers will be used to analyze data, prepare engineering graphs for reports, and perform analytic studies. Knowledge of word-processing, spreadsheet, and analysis software (i.e., Word, Excel, Matlab, etc.) is required.

The circuit analysis software that we will be using is either LTspice from Analog Devices or Pspice from OrCad.

For LTspice the software is free, is available for both Windows and Mac operating systems, and can be downloaded here:

http://www.linear.com/designtools/software/

A free student version of PSpice, called OrCad Lite (another circuit analysis software program similar to LTspice) is also available. It can be downloaded here:

https://www.orcad.com/resources/download-orcad-lite

An excellent PSpice tutorial prepared by Dr. John Gilmer can be found at

http://www.jbgilmer.com/EE283/PSPICE%20tutorial.pdf

LTspice and the full version of PSpice are available in the SLC-216 computer lab and on the computers in SLC-193

Lab Reports: Graded material will include lab reports for each lab exercise that are handed in at the beginning of the next laboratory session. The reports are to be handed in on paper. No emailed reports will be accepted. Reports that are not handed in on time will have 10% deducted from the grade for every week that they are late. Reports that are more than two weeks late will not be accepted.

The reports will usually include figures for circuits, and graphs for results. Values given are to have appropriate units, and are to be presented with an appropriate number of significant digits. Graphs and figures are to be properly annotated and have a white background. Students will be expected to construct graphs in Excel using the lab exercise results, and include the graphs and data in the report. Good report writing is the key to a successful engineering career. Dr. John Gilmer has written the Engineering Laboratory Reports Manual which can be downloaded here.

http://www.jbgilmer.com/LabManual/LabManual.htm

This manual has lots of examples of what makes up a good (and not so good) engineering report. Copies of the manual will be available in SLC-193.

Two types of report formats will be used. The first is a “formal” report which will be used for lab exercises 2, 6 and 9. The format for the “formal” reports is shown in the appendix. The report must contain all of the items shown in the appendix. The second type of report is a “form” report which will be used for lab exercises 1, 3, 4, 5, 7, 8, 10, 11 and 12. The “form” report is a simplified version of the “formal” report and the format will be included with each exercise that requires a “form” report.

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Grading: There will be two practical examinations. The first is before mid-term, concerning DC circuits. The second is at the time of final examinations, concerning AC circuits. Each exam will count for 20% of the final grade. Each lab exercise "formal" report will count for 8% of the final grade and each lab exercise "form" report will count for 4% of the final grade.

All materials will be collected and graded on the basis of 100 points. Graded material will be averaged with the weightings given above, then converted to Wilkes's 4.0 scale as follows:

90-100	4.0
85-89	3.5
80-84	3.0
75-79	2.5
70-74	2.0
65-69	1.5
60-64	1.0
below 60	0.0

Laboratory reports, graphs, simulation results, and other submitted graded material is to be the work only of the individual student. If there are two students at a lab station each partner can use the same data but each student must write his own report. You may get help of a general nature from other students, such as the general approach to solving a problem, but not any data, text, figures, or other material specific to the problem. If a student has been found to have inappropriately copied from another student, or has furnished another student with material from which a copy was made, a grade of zero will be awarded for that exercise or perhaps the entire course if that seems to be warranted. If the work in question is an obvious copy of another student's work, that violation of academic integrity is flagrant enough to earn a zero in the course. Attendance is mandatory. Missing two lab sessions, unless excused, will result in a failing grade for the course. Missed lab sessions must be made up, or will be given a zero grade.

The instructor or an assistant will visit your station to observe the correct operation of your circuit.

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Schedule:

Lab # (Dates)	Topic	Notes	Report Type
1 (8-29 or 30)	Introduction to LTspice, Equipment Operation and Resistance Measurements	Power Supply, DMM, resistor color code, voltage and current for a resistor and a lamp. Explain breadboard.	Form
2 (9-5 or 6)	Voltage and Current Measurements, Maximum Power Measurement	Using a DMM and VOM for different impedance levels. Maximum power calculation and measurement.	Formal
3 (9-12 or 13)	KCL and KVL Measurements, Node Analysis	MatLab, Excel, hand calculation	Form
4 (9-19 or 20)	Superposition, Thevenin and Norton Theorems	DC Analysis	Form
(9-26 or 27)	DC Practical Exam		
5 (10-3 or 4)	RL and RC circuits	Gain and Phase shift.	Form
(10-10 to 10-13)	Fall Recess		
6 (10-17 or 18)	RLC Node Analysis	MatLab, Excel, hand calculation	Formal
7 (10-24 or 25)	OP AMPS	Inverting, Noninverting	Form
8 (10-31 or 11-1)	OP AMPS	Active Filter	Form
9 (11-7 or 8)	RLC circuits, Resonance, Bandwidth	Impedance measurement	Formal
10 (11-14 or 15)	Digital Project		Form
11 (11-21or 22)	Digital Project		Form
12 (11-26 or 12-6)	Full Wave Rectifier	FWR plus voltage regulator	Form
(12-5 or 9)	AC Practical Exam		

Appendix:

Format of "Formal" Lab Report:

LABORATORY XX

TITLE

(Indicate the lab title and number)

NAME - Give your name.

DATE - Indicate the date the lab was performed.

OBJECTIVE - Clearly state the objective of performing the lab.

EQUIPMENT USED - Indicate which equipment was used in performing the experiment. The manufacturer and model number should be specified.

PROCEDURE - Provide a concise summary of the procedure used in the lab. Include any modifications to the experiment.

DATA - Provide a record of the data obtained during the experiment. Data should be retrieved from the lab notebook and presented in a clear manner using tables. All tables should try and fit on one page.

OBSERVATIONS AND DISCUSSIONS - The student should state what conclusions can be drawn from the experiment. Plots, charts, other graphical medium, and equations should be employed to illustrate the student's viewpoint. Sources of error and percent error should be noted here.

QUESTIONS - Questions pertaining to the lab may be answered here. These questions may be answered after the lab is over.

CONCLUSIONS - The student should present conclusions which may be logically deduced from his/her data and observations.

SIGNATURE - Sign your report at the end. Include the statement - "This report is accurate to the best of my knowledge and is a true representation of my laboratory results."

Note: If a lab exercise has two separate components format the report as follows:
Component 1:

- Procedure
- Data
- Observations and Discussions
- Questions
- Conclusions

Component 2

- Procedure
- Data
- Observations and Discussions
- Questions
- Conclusions