ENGR M20L: ELECTRICAL ENGINEERING FUNDAMENTALS LAB

Originator
srelle

College
Moorpark College

Discipline (CB01A)
ENGR - Engineering

Course Number (CB01B)
M20L

Course Title (CB02)
Electrical Engineering Fundamentals Lab

Banner/Short Title
Elec Engr Fundamentl Lab

Credit Type
Credit

Start Term
Spring 2020

Catalog Course Description
Examines the operation of basic electrical and electronic circuits. Provides practical knowledge for designing, constructing, and trouble shooting of electrical circuits and basic operational amplifier circuits using real circuit components and circuit simulation software. Teaches the basic use of electrical testing and measuring instruments, including multimeters, oscilloscopes, function generators, and power supplies, while considering tolerance value and non-ideal aspects of laboratory instruments. Emphasizes the interpretation of measured and simulated data based on principles of circuit analysis for direct current, transient, and sinusoidal steady-state or alternating current conditions.

Taxonomy of Programs (TOP) Code (CB03)
0924.00 - *Engineering Technology, General (requires Trigonometry)

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Alternate grading methods
Student Option- Letter/Pass
Pass/No Pass Grading

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class

Total Student Learning

Total Student Learning

Total Minimum Student Learning Hours

52.5

Total Maximum Student Learning Hours

52.5

Minimum Units (CB07)

1

Maximum Units (CB06)

1

Prerequisites

PHYS M20BL and ENGR M20 or concurrent enrollment

Entrance Skills

Prerequisite Course Objectives

ENGR M20-analyze DC circuits to find current, voltage, resistance, power, and/or energy.
ENGR M20-draw and label circuit diagrams and show thorough mathematical solutions.
ENGR M20-apply different circuit analysis techniques and demonstrate a process for selecting an appropriate technique for a given problem.
ENGR M20-solve circuits containing two or more operational amplifiers (Op Amps).
ENGR M20-find the transient response and complete response for resistor-capacitor (RC), resistor-inductor (RL), and RLC circuits involving DC sources.
ENGR M20-solve AC circuits by using phasors.
ENGR M20-calculate average and complex power for AC circuits.
PHYS M20BL-assemble and perform experiments in thermodynamics and electromagnetism following instructions in the laboratory manual.
PHYS M20BL-measure and record the data, including estimated uncertainty, using appropriate units and significant figures.
PHYS M20BL-reduce and analyze real-world experimental data, calculate uncertainties, produce and analyze graphs, and summarize the experiment and its results using an appropriate technical writing style.
PHYS M20BL-critically evaluate the experimental results and procedures using accepted values and other relevant information and draw conclusions regarding the efficacy of the experimental procedure related to the lecture portion of the class.
PHYS M20BL-suggest changes to the experimental procedure which, if implemented, could reduce the experimental uncertainty and/or error.
PHYS M20BL-suggest practical applications for the values measured, conclusions reached, or methods utilized in the experiment.

Requisite Justification

Requisite Type

Prerequisite

Requisite

PHYS 20BL - Thermodynamics, Electricity, Magnetism Lab

Requisite Description

Course not in a sequence

Level of Scrutiny/Justification

Required by 4 year institution

Requisite Type

Prerequisite

Requisite
ENGR M20 - Electrical Engineering Fundamentals

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Corequisite

Requisite
ENGR M20 - Electrical Engineering Fundamentals

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	perform experiments with electrical and electronic circuits in hands-on laboratory work.
2	make measurements using common electrical engineering laboratory instruments and record the data.
3	analyze data, construct and examine graphs, and write formal or informal laboratory reports using appropriate technical writing format and language.
4	reduce and analyze the data for error propagation, critically evaluate the experimental results based on expected theoretical values and/or other relevant information, and draw conclusions regarding the experimental procedures.
5	use Personal Simulation Program with Integrated Circuit Emphasis (PSPICE) or similar computer software, to design and analyze electrical and electronic circuits of average complexity appropriate for the course.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	select and correctly use basic electrical testing and measuring devices including multimeters, oscilloscopes, function generators, and power supplies.
2	read circuit schematics and construct linear circuits using resistors, capacitors, inductors, and/or operational amplifiers (op amps).
3	verify experimentally the operation of a variety of direct current (DC) and alternating current (AC) electrical circuits by measuring voltage, resistance, current, and power.
4	test circuits, analyze data, and compare measured circuit performance to theory and simulation.
5	use a circuit simulation program, such as Personal Simulation Program with Integrated Circuit Emphasis (PSPICE) or Multiple Simulator Networking Program (MultiSIM), and other computer applications, such as matrix laboratory (MATLAB) or Microsoft Excel (MS Excel), to predict or describe circuit behavior.
6	troubleshoot and repair simple electric and electronic circuits.
7	record and document results of laboratory experiments using inscription and graphs.
8	work effectively in groups by sharing responsibilities and collaborating on findings.

Course Content

Lecture/Course Content
Not applicable.

Laboratory or Activity Content

1. **(5%) - Laboratory safety**
2. **(25%) - Verifying lecture concepts**
   a. Kirchhoff's current law (KCL)
   b. Kirchhoff's voltage law (KVL)
   c. Ohm's law
   d. Voltage and current division
   e. Power dissipation
   f. Series and parallel circuits
   g. Equivalent circuits
   h. Thevenin equivalent circuit
   i. Concept of superposition
3. **(12%) - Step response of resistor-inductor (RL), resistor-capacitor (RC), and resistor-inductor-capacitor (RLC) circuits**
4. **(12%) - Frequency response of RL, RC, and RLC circuits, including resonance**
5. **(10%) - Operational amplifiers (op amp) and practical voltage and current limits on the output of these devices**
6. **(12%) - Circuit component identification, differences between nominal and measured values, limitations on voltage, current, and power dissipation**
7. **(12%) - Circuit construction techniques for laboratory use, also known as breadboarding**
8. **(12%) - Testing and measuring devices each used for a specific purpose**
   a. Multimeter
   b. Oscilloscope
   c. Function generator
   d. Power supply

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Classroom Discussion
Group projects
Individual projects
Laboratory activities
Laboratory reports
Objective exams
Problem-solving exams
Participation
Quizzes
Reports/Papers/Journals
Reports/papers
Skills demonstrations
Skill tests
Simulations

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Computer-aided presentations
Collaborative group work
Class activities
Class discussions
Demonstrations
Group discussions
Guest speakers
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Laboratory activities
Small group activities

Describe specific examples of the methods the instructor will use:

For each lab activity the instructor will:

- explain the applicable theory and background information
- explain the use of technology and instrumentation as appropriate
- demonstrate the data collection and analysis techniques as appropriate

Representative Course Assignments

Writing Assignments

1. Respond to questions in laboratory assignments, quizzes, or tests which require either a brief explanation or an essay. An example would be: For measuring voltage, is the voltmeter connected in series or in parallel with the circuit components?

2. Prepare formal laboratory reports which conform to the style specified by the instructor, or in the laboratory manual, using appropriate technical writing style. An example would be: Using Institute of Electrical and Electronics Engineers' (IEEE's) writing style, prepare a formal laboratory report on the experimental verification of Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL).

Critical Thinking Assignments

1. Compare and contrast the various experimental methods which can be used to achieve the objectives of an experiment. An example would be: Describe two experimental procedures that can be used to verify Thevenin equivalent circuit theory. Construct and test the circuits for the verification of the theory. Discuss the advantages and drawbacks of each circuit.

2. Troubleshoot by locating and identifying a faulty component in a given malfunctioning circuit having specific symptoms using analytical and experimental techniques learned in class.

Reading Assignments

1. Read the relevant sections of the Electrical Engineering Laboratory Manual used in the course or the laboratory handout prepared by the instructor to prepare for the weekly experimental work.
2. Read circuit schematics and construct the equivalent circuit using the electrical and electronic components provided by the instructor in the lab.

Skills Demonstrations

1. Demonstrate the ability to breadboard using various circuit components introduced in the lab.

2. Demonstrate the ability to use Personal Simulation Program with Integrated Circuit Emphasis (PSPICE) to simulate and analyze a circuit design.

Outside Assignments

Articulation

C-ID Descriptor Number

ENGR 260L

Status

Approved

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
UC, Riverside	EE 1LA	Engineering Circuit Analysis I Lab	1
CSU Chico	EECE 211L	Linear Circuits I Activity	1
UC, Los Angeles	EC ENGR 11L	Circuits Lab I	1
CSU, Los Angeles	EE 2049	Electrical Measurements and Circuits Lab	1
Cal Poly, SLO	EE 241	Electric Circuit Analysis Lab II	1
CSU, Northridge	ECE 240L	Electrical Engineering Fundamentals Lab	1

Comparable Courses within the VCCCD

ENGR V16L - Elec Circuits & Devices Lab

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Fall 1995

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Approved

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Manual

Description
Boylestad, Robert L., and Gabriel Kousourou. *Laboratory Manual for Introductory Circuit Analysis.* 13th ed. Pearson, 2015.

Resource Type
Manual

Description
Tront, Joseph G. *PSpice for Basic Circuit Analysis.* 2nd ed. McGraw-Hill, 2006.

Resource Type
Manual

Description
Dean, Brian. *Introduction to Analog and Digital Circuits Lab Manual*. Kendall Hunt, 2018.

Resource Type
Software

Description
PSpice. Cadence, 9.1 ed.
PSpice is an acronym for Personal Simulation Program with Integrated Circuit Emphasis. This simulation program is for Microsoft Windows. http://www.cadencepcb.com/ http://www.electronicslab.com/downloads/schematic/013/

Library Resources

Assignments requiring library resources
N/A

Sufficient Library Resources exist
Yes

Primary Minimum Qualification
ENGINEERING

Review and Approval Dates

Department Chair
10/31/2019

Dean
10/31/2019

Technical Review
11/07/2019

Curriculum Committee
11/19/2019

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
12/03/2019

Control Number
CCC000433635

DOE/accreditation approval date
MM/DD/YYYY