ENGR R160: ELECTRONIC CIRCUITS AND DEVICES

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
ENGR - Engineering

Course Number (CB01B)
R160

Course Title (CB02)
Electronic Circuits and Devices

Banner/Short Title
Electronic Circuits

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This course provides an introduction to the analysis of electrical circuits. The use of analytical techniques based on the application of circuit laws and network theorems is the main focus of the course. The analysis of DC and AC circuits containing resistors, capacitors, inductors, dependent sources, operational amplifiers, and/or switches shall be employed. Natural and forced responses of first and second order RLC circuits, the use of phasors, AC power calculations, power transfer, and energy concepts are other general topics that are covered in this course.

Taxonomy of Programs (TOP) Code (CB03)
0901.00 - Engineering, General (requires Calculus) (Transfer)

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)
E - Non-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

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

Activity

Laboratory

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
Minimum Outside-of-Class Hours
105
Maximum Outside-of-Class Hours
105

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
PHYS R132 and MATH R143 or concurrent enrollment

Requisite Justification

Requisite Type
Prerequisite

Requisite
PHYS R132

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Prerequisite

Requisite
MATH R143

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Concurrent

Requisite
MATH R143

Requisite Description

Course not 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	Analyze a circuit using Kirchhoff's laws, mesh and nodal analysis, and network theorems.
2	Apply phasors and the concept of impedance to analyze a circuit with sinusoidal input under steady-state conditions and to find the frequency response of a linear, time-invariant circuit.
3	Find the complete response for a first and second-order circuit to input signals modeled by waveforms that are dc, step, window, ramp, decaying exponential, or sinusoidal.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Analyze DC circuits to find current, voltage, resistance, power, and/or energy.
2	Draw and label circuit diagrams and show thorough mathematical solutions.
3	Apply different circuit analysis techniques and demonstrate a process for selecting an appropriate technique for a given problem.
4	Solve circuits containing two or more Op Amps.
5	Find the transient response and complete response for RC, RL, and RLC circuits involving DC sources.
6	Solve AC circuits by using Phasors.
7	Calculate average and complex power for AC circuits.

Course Content

Lecture/Course Content

1. Electric Circuit Variables
   a. Electric Circuits and Current
   b. Systems of Units
   c. Voltage
   d. Power and Energy
   e. Circuit Analysis and Design
2. Circuit Elements
   a. Ohm's Law
   b. Equivalent Circuits
   c. Engineering and Linear Models
   d. Active and Passive Circuit Elements
   e. Independent Sources
   f. Voltmeters and Ammeters
   g. Dependent Sources
   h. Transducers
   i. Switches
3. Resistive Circuits
   a. Kirchhoff's Laws
   b. Series Resistors and Voltage Division
   c. Parallel Resistors and Current Division
   d. Series Voltage Sources and Parallel Current Sources Circuit Analysis
4. Methods of Analysis of Resistive Circuits
   a. Node Voltage Analysis of Circuits with Current Sources
   b. Node Voltage Analysis of Circuits with Current and Voltage Sources
   c. Node Voltage Analysis with Dependent Sources
   d. Mesh Current Analysis with Independent Voltage Sources

   e. Mesh Current Analysis with Current and Voltage Sources
   f. Mesh Current Analysis with Dependent Sources
   g. The Node Voltage Method and Mesh Current Method Compared
5. Circuit Theorems
   a. Source Transformations
   b. Superposition
   c. Thevenin's Theorem
   d. Norton's Equivalent Circuit
   e. Maximum Power Transfer
6. The Operational Amplifier
   a. The Ideal Operational Amplifier
   b. Nodal Analysis of Circuits Containing Ideal Operational Amplifiers
   c. Design Using Operational Amp
   d. Voltage gain and current limitations of non-ideal op amp circuits
7. Energy Storage Elements
   a. Capacitors
   b. Energy Storage in a Capacitor
   c. Series and Parallel Capacitors
   d. Inductors
   e. Energy Storage in an Inductor
   f. Series and Parallel Inductors
   g. Initial Conditions of Switched Circuits
   h. Operational Amplifier Circuits and Linear Differential Equations
8. The Complete Response of RL and RC Circuits
   a. First-Order Circuits
   b. The Response of a First-Order Circuit to a Constant Input
   c. Sequential Switching
   d. Stability of First-Order Circuits
   e. The Unit Step Source
   f. The Response of a First-Order Circuit to a Non-constant Source
   g. Differential Operators
9. The Complete Response of Circuits with Two Energy Storage Elements
   a. Differential Equation for Circuits with Two Energy Storage Elements
   b. Solution of the Second-Order Differential Equation—The Natural Response
   c. Natural Response of the Unforced Parallel RLC Circuit
   d. Natural Response of the Critically Damped Unforced Parallel RLC Circuit
   e. Natural Response of an Underdamped Unforced Parallel RLC
   f. Forced Response of an RLC Circuit
   g. Complete Response of an RLC Circuit
10. Sinusoidal Steady-State Analysis
   a. Sinusoidal Sources
   b. Phasors and Sinusoids
   c. Impedances
   d. Series and Parallel Impedances
   e. Mesh and Node Equations
   f. Thevenin and Norton Equivalent Circuits
   g. Superposition
   h. Phasor Diagrams
   i. Op Amps in AC Circuits
   j. The Complete Response
11. AC Steady-State Power
   a. Electric Power
   b. Instantaneous Power and Average Power
   c. Effective Value of a Periodic Waveform
   d. Complex Power
   e. Power Factor
   f. The Power Superposition
   g. The Maximum Power Transfer Theorem

h. Coupled Inductors
i. The Ideal Transformer

12. Frequency Response
    a. Gain, Phase Shift, and the Network Function
    b. Bode Plots
    c. Resonant Circuits
    d. Frequency Response of Op Amp

Laboratory or Activity Content

None

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
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):

Computational homework
Objective exams
Other (specify)
Problem-Solving Assignments
Quizzes

Other

Essays

Instructional Methodology

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

Computer-aided presentations
Distance Education
Demonstrations
Instructor-guided interpretation and analysis
Small group activities

Describe specific examples of the methods the instructor will use:

1. Computer aided presentation: The instructor may employ the computer to aid in the presentation of course materials which would include simulations of specific phenomena such as the flow of electrical charge in a given DC circuit and computerized graphical representations of aspects of a system such as oscillations in an under-damped RLC circuit.
2. Demonstrations: The instructor will demonstrate electrical engineering principals by employing equipment and other items such as function generators, oscilloscopes, and circuits. For instance; when studying RLC series circuit attenuation, the instructor may show the trace of such on a oscilloscope for a given circuit.
3. Distance Education: When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meetings will be used to allow students to ask questions regarding the course and its material.
4. Instructor guided analysis: The instructor will work through electrical engineering problems during lecture that investigate a given system in which the students will follow along, answering questions posed by the instructor. This will also serve as a forum for students to ask particular questions regarding the logic and methods employed to come to certain conclusions regarding said problem/system.
5. Lecture: The instructor will deliver the course subject matter via in person lectures to the students. For example, a lecture on Kirchhoff's voltage and current laws.
6. Small group activities: These may be employed in the form of group quizzes where students work together in small groups to solve some electrical engineering problems regarding current material.

Representative Course Assignments

Writing Assignments

Writing analytical explanations of operational features of a given circuit often assigned from among those at the end of each chapter or posed by the instructor, generally assigned weekly. For instance, describe in detail the effects of doubling the resistance of the RLC series circuit shown in the diagram.

Critical Thinking Assignments

Answering a wide array of homework, quiz, and exam questions requiring the analysis of a given physical system or circumstance in order to come to the correct conclusion and/or answer regarding the question and/or desired outcome.

Reading Assignments

1. Regular textbook readings that reinforce the concepts discussed or demonstrated during the class meetings; these readings generally include theory and principles, descriptions of important engineering feats that relied on circuitry, data tables, definitions, problem-solving examples, and practical applications of electronic circuits in everyday life and in specialized environments.

Skills Demonstrations

None

Other assignments (if applicable)

None

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook typically amounting to 1 chapter a week. This will amount to 1.5 hours per week of reading.
2. Assigned conceptual and problem solving based homework that further investigates and explores the notions and theories discussed throughout the course. Typically, homework sets will require 4.5 hours to fully complete and will be due on a weekly basis.
3. Studying and preparing for quizzes and exams.

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

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:

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
Textbook

Description
Alexander, C. & Sadiku, M. (2017). *Fundamentals of Electric Circuits* (6th). New York, McGraw-Hill Education.

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%—50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	The Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

Hybrid (51%—99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	The Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	The Students will have access to a discussion board in which they can ask questions regarding the course material.

Examinations

Hybrid (1%–50% online) Modality
Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
ENGINEERING

Review and Approval Dates

Department Chair
09/05/2020

Dean
09/05/2020

Technical Review
09/23/2020

Curriculum Committee
09/23/2020

Curriculum Committee
11/25/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000599716

DOE/accreditation approval date
MM/DD/YYYY