ENGT M20: ELECTRONIC DEVICES

Originator
srelle

Co-Contributor(s)

Name(s)
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College
Moorpark College

Attach Support Documentation (as needed)
Engr Adv Comm Meet_Agenda_2018.pdf
Recommendations of the committee.pdf
Attendees for Spring 2019 Advisory Committee.pdf
Engr Adv Comm Meet_Agenda_2019.pdf
Recommendations - Spring 2018.pdf
Attendees for 2018 Engineering Advisory Committee.pdf

Discipline (CB01A)
ENGT - Engineering Technology

Course Number (CB01B)
M20

Course Title (CB02)
Electronic Devices

Banner/Short Title
Electronic Devices

Credit Type
Credit

Start Term
Fall 2020

Catalog Course Description
Introduces electronic devices as components of electrical circuits responsible for regulating current flow for information processing and system control. Examines the purpose, construction, and circuit application of diodes, light-emitting diodes (LEDs), transistors, thyristors, integrated circuits (ICs), and optoelectronics. Explains the operation and the uses of potentiometers, switches, fuses, relays, and transformers. Applies basic electronic theory to analytical problem solving, experimentation, and circuit design relevant to the usage of the various electronic devices.

Taxonomy of Programs (TOP) Code (CB03)
0934.00 - *Electronics and Electric Technology

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

Course Transfer Status (CB05) (select one only)
B (Transferable to CSU only)

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)
A - Primarily Developed Using Economic Development Funds

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
May be required

Faculty notes on field trips; include possible destinations or other pertinent information
Naval Base in Point Mugu or in Port Hueneme; local engineering companies

Grading method
Letter Graded

Alternate grading methods
Credit by exam, license etc.

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
35
Maximum Contact/In-Class Lecture Hours
35

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
87.5
Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
70
Maximum Outside-of-Class Hours
70

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
ENGT M04

Entrance Skills

Prerequisite Course Objectives

ENGT M04-solve basic electronic problems related to direct current involving resistance, current, voltage, and power applied to both simple and complex combinations of series and parallel circuit components, comprised of resistors, capacitors and coils, in a given network configuration.
ENGT M04-diagram and discuss the relationship between electricity and magnetism as related to a direct current permanent magnet motor, a solenoid or an electromechanical relay.
ENGT M04-describe and contrast the construction, operation, and purpose of resistors, potentiometers, switches, fuses, relays, and batteries.
ENGT M04-explain the basic principles of sinusoidal sources of Alternating Current (AC) and solve AC network circuit problems involving resistors, capacitors, inductors and transformers.
ENGT M04-discuss the purpose and effects of resistors, capacitors, inductors and/or transformers in a given AC network problem, analyze it and diagram the solution to a posed problem by using J-Factors (complex numbers) appropriately and accurately.

Requisite Justification

Requisite Type

Prerequisite

Requisite

ENGT M04

Requisite Description

Course in a sequence

Level of Scrutiny/Justification

Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	explain the basic functions, operations, and architecture of electronic devices.
2	incorporate the proper electronic device in a circuit or an electric system to achieve a specified outcome or for a specified application.
3	troubleshoot a circuit or an electric system containing a malfunctioning electronic device using analytical and experimental techniques learned in class.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	explain the basic functions, operations, and architecture of electronic devices and demonstrate their appropriate usage in circuits or electric systems.
2	explain the fundamentals, electrical characteristics, and applications of semiconductor optoelectronic devices and demonstrate their appropriate usage in circuits or electric systems.
3	explain the operation and biasing requirements of diodes, bipolar transistors, field effect transistors, and thyristors, and demonstrate their appropriate usage in circuits or electric systems.
4	discuss the construction and uses of analog and digital integrated circuits.
5	discuss the three basic types of transistor amplifier configurations, describe their operation, and compare the characteristics of each.

Course Content

Lecture/Course Content

- **10% - Diodes and LEDs**
  - Operation and application in circuits
  - Characteristic current-voltage curves
  - Rectifying, limiting, clipping, clamping, and voltage multiplying circuits
- **15% - Semiconductors for Special Applications: Operations and Circuit Functions**
  - Thyristors
  - Silicon controlled rectifiers
  - Metal Oxide Semiconductor Field Effect Transistors (MOSFETs)
  - Integrated circuits (ICs)
- **15% - Bipolar Transistors**
  - Identification, operation, and testing
  - Multi-transistor switching circuits
  - Linear operation
  - Circuit applications
- **10% - Junction Field Effect Transistors (JFETs)**
  - Identification, operation, and testing
  - Characteristic curves
  - Biasing methods
  - Circuit applications
- **15% - Optoelectronic Devices**

- Nature and characteristics of light
- Luminescence, display devices, types of lasers and their applications
- Mechanisms of optical detection
- Light modulation techniques, and optical switching concepts and applications
- Optoelectronic integrated circuits in transmitters and receivers

- **20% - Amplifiers: Common Emitter/Collector, Differential, Operational, Power**
  - Basic operation and characteristics
  - Circuit analysis and design
- **15% - Basic Operating Principles and Circuit Applications of Various Circuit Elements**
  - Power supplies
  - Voltage regulators
  - Switches
  - Fuses
  - Relays
  - Transformers
  - Potentiometers

Laboratory or Activity Content

- **10% - Diode Characteristics**
  - Measure and plot the forward and reverse current-voltage characteristic curves for a diode
  - Perform diode tests with an ohmmeter
  - Test the effect of heat on diode's response
  - Measure the alternating current resistance of a diode
- **10% - Rectifier Circuits**
  - Construct half-wave, full-wave, and bridge rectifier circuits, and compare the input/output voltage for each
  - Connect a filter capacitor to each circuit and measure the ripple voltage and ripple frequency
- **10% - Diode Limiting and Clamping Circuits**
  - Explain the difference between limiting and clamping circuits
  - Calculate and measure the voltage limits of both biased and unbiased limiting circuits
  - Predict and measure the effect of a direct current bias voltage on a clamping circuit
- **10% - Bipolar Junction Transistor Characteristics**
  - Measure and graph the collector characteristic curves for a bipolar junction transistor
  - Use the characteristic curves to determine the direct current amplification factor (DC Beta) of the transistor at a given point
- **15% - Bipolar Transistor Biasing**
  - Construct and analyze three types of transistor bias circuits: base bias, voltage divider bias, and collector feedback bias
  - Compare the stability of the bias with different transistors
  - Select appropriate bias resistors for each type of bias circuit
- **15% - Operational Amplifiers (Op Amps)**
  - Measure the operating characteristics of an Op Amp
  - Design and construct an Op Amp voltage comparator and a voltage follower circuit
- **15% - Operations and Circuit Functions of Semiconductors**
  - Measure and graph characteristic curves for a given MOSFET
  - Design and construct a MOSFET switching circuit
  - Design an IC voltage regulator circuit according to a given set of specifications
- **15% - Operating Characteristics of Optoelectronic Devices**
  - Examine the construction and the function of a transmitter and a receiver in a fiber optic system
  - Generate analog and digital signals through fiber optics and draw the wave forms
  - Determine electrical-to-optical (E-O) characteristics of fiber optic converters
  - Determine attenuation or optical losses in fiber optics between input and output signals

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

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

Group projects
Individual projects
Laboratory activities
Laboratory reports
Objective exams
Performances
Problem-solving exams
Quizzes
Skills demonstrations
Skill tests

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
Field trips
Group discussions
Guest speakers
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Internet research
Laboratory activities
Lecture
Practica
Small group activities

Describe specific examples of the methods the instructor will use:

The instructor will use PowerPoint presentations, problem solving exercises, and demonstrations to explain the concepts of the course.

Representative Course Assignments

Writing Assignments

1. Answer questions from lectures, such as: Explain the advantages of using a voltage follower amplifier and provide three examples of its uses.

2. Provide a technical report for an assigned group project, such as: Design an analog circuit to help your colleague who is a biomedical engineer to be able to detect and measure small hand or arm movements from a stroke patient. Determine the electrical components which you will need for your circuit, create a schematic of your circuit design, prototype your circuit, and write a 3 page technical report describing your circuit design and how it meets the objectives of the project.

Critical Thinking Assignments

1. Design, construct, and test circuits in which certain electronic devices can be made to perform in a capacity which is other than their original intent. An example would be: Design four different circuits where in each of them some combination of diodes and transistors are used as switches.

2. Troubleshoot by locating and identifying a faulty component in a given malfunctioning circuit or system having specific symptoms using analytical and experimental techniques learned in class. An example would be: In a circuit the electric motor is supposed to turn on whenever the cadmium sulfide photocell is
darkened. But the motor refuses to turn on no matter how little light strikes the photocell. How might you determine what is faulty in this circuit and the exact location of the fault? Also, how would you quickly determine what is not faulted in the circuit so that you don't waste time and money.

Reading Assignments

1. Read assigned chapters from the textbook to prepare for lectures and laboratory experiments which will reinforce the ability to recognize the various electronic devices, predict their performance analytically, and verify their function experimentally.

2. Read scientific and technical journal articles relevant to advances in electronic devices to expand understanding of their usage in circuit design and simplification needed in various industrial processes.

Skills Demonstrations

1. Demonstrate the ability to construct and test the functionality of analog or digital circuits using the various electronic devices provided in the lab.

2. Demonstrate the ability to troubleshoot a malfunctioning analog or digital circuit containing one or more of the various electronic devices discussed in the course using the appropriate testing tools.

Outside Assignments

Representative Outside Assignments

1. Prepare an oral presentation to explain the progression of thought and action, as prescribed by the Engineering Design Process, in designing, testing, and troubleshooting an analog or a digital circuit involving more than one electronic device aimed at achieving a specified outcome.

2. Research on the Internet the practical uses of different types of optoelectronic devices such as telecommunication laser, blue laser, optical fiber, LED traffic lights, photo diodes, and solar cells in our current technology and industry.

Articulation

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Imperial Valley College	ELTR 120	Electronic Devices	4
Irvine Valley College	ET 105	Electronic Devices and Circuits I	4
Irvine Valley College	ET 107	Electronic Devices and Circuits II	4
Los Angeles City College	ELECTRN 8	Electronic Devices	4
Norco College	ELE 23	Electronic Devices and Circuits	4
Santa Rosa Junior College	ELEC 54B	Fundamentals of Electronic Devices	3

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 2020

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

Classic Textbook
No

Description
Bogart, T.F., Beasley, J.S. and Rico, G. (2019). *Electronic devices and circuits*, (6th ed.). Pearson.

Resource Type
Textbook

Classic Textbook
No

Description
Boylestad, R., and Nashelsky, L. (2012). *Electronic devices and circuit theory,* (11th ed.). Pearson.

Resource Type
Textbook

Classic Textbook
No

Description
Diffenderfer, R. (2005). *Electronics devices: systems and applications. Cengage.*

Resource Type
Manual

Description
Boylestad, R., Nashalsky, L., and Monssen, F. (2012). *Lab manual for Electronic devices and circuit* theory, (11th ed.). Pearson.

Library Resources

Assignments requiring library resources
Writing, reading, critical thinking, outside assignments

Sufficient Library Resources exist
Yes

Example of Assignments Requiring Library Resources
Using Library's online or print resources research the various applications of semiconductors in analog and digital circuits.

Primary Minimum Qualification
ENGINEERING TECHNOLOGY

Review and Approval Dates

Department Chair
09/08/2019

Dean
09/11/2019

Technical Review
09/19/2019

Curriculum Committee
10/01/2019

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
MM/DD/YYYY

DOE/accreditation approval date
MM/DD/YYYY