EET-2120: ELECTRONICS I

Cuyahoga Community College

Viewing: EET-2120 : Electronics I

Board of Trustees:

May 2023

Academic Term:

Fall 2023

Subject Code

EET - Electrical/Electronic Engineer

Course Number:

2120

Title:

Electronics I

Catalog Description:

Course includes the most common solid-state devices used in electronic circuits: silicon and germaniumn diodes, zener diodes, Light Emitting Diodes (LEDs) Bipolar Junction Transistors (BJTs), and Field Effect Transistors (FETS). Graphical and analytical DC and AC analysis of various electronic circuits used. Computer circuit analysis program MultiSim used to predict DC voltages and currents and frequency response of different circuits. Laboratory experiments reinforce topics studied in lecture.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

2

Other Hour(s):

0

Requisites

Prerequisite and Corequisite

EET-1210 AC Electric Circuits; or departmental approval.

Outcomes

Course Outcome(s):

Determine and explain the properties of discrete semiconductors including diodes (silicon, germanium, zener, and light-emitting), bipolar junction transistors (NPN and PNP), and field effect transistors (P Channel and N Channel).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe discrete semiconductor devices such as the Silicon and Germanium PN junction diode, zener diode, Light Emitting Diode, NPN and PNP transistor, and P and N channel field effect transistors.
2. Write comprehensive reports regarding the theoretical, simulated and measured circuit results.
3. Analyze using theoretical calculations and simulation DC power supplies, and various DC biasing circuits using bipolar junction transistors and field effect transistors.
4. Analyze using theoretical calculations and simulation the small-signal model for diodes, zeners, bipolar junction transistor and field effect transistor circuits.
5. Describe and analyze negative feedback circuits and their effect on input impedance, voltage gain, current gain, and output impedance.

6. Explain the operation of oscillator circuits and regulator circuits.

Course Outcome(s):
Use instrumentation to determine the functionality of circuits that use discrete semiconductor devices.

Objective(s):
1. Test discrete semiconductor devices.
2. Use and explain circuit simulation software on circuits that use discrete semiconductor devices.
3. Debug laboratory assignments.

Course Outcome(s):
Design circuits using discrete semiconductor devices.

Objective(s):
1. Design circuits using discrete semiconductor devices.

Course Outcome(s):
Use Simulation to determine the functionality of circuits that use discrete semiconductor devices.

Objective(s):
1. Verify theoretical and/or measured lab results using a software simulation program.

Methods of Evaluation:
a. Homework
b. Laboratory reports
c. Quizzes
d. MultiSim computer simulation program
e. Midterm examination
f. Final examination

Course Content Outline:
a. Solid-state theory
    i. PN junction diode
    ii. Zener diode
    iii. Light Emitting Diode
    iv. Clippers and clamps
    v. Rectification using diodes
    vi. DC power supplies
b. Bipolar junction transistor
    i. Transistor characteristic curves
    ii. Transistor regions of operation
    iii. Transistor load-lines
    iv. Maximum power dissipation curve
    v. Transistor specifications
c. DC biasing of bipolar junction transistor
    i. Fixed bias circuit
    ii. Emitter bias with single base resistor
    iii. Emitter bias with voltage divider
    iv. Collector base bias
    v. Collector base bias with emitter resistor
    vi. Emitter bias with two supplies
d. Stability, compensation, and temperature

   i. Leakage currents
   ii. Bias stabilization
   iii. MultiSim computer analysis
e. Small-signal analysis of transistor circuits
   i. The hybrid model and the r model
   ii. Amplifier gain
   iii. Application of the common base amplifier
   iv. Application of the common collector amplifier
   v. Application of the common emitter amplifier
   vi. Approximation to the AC model
f. Field Effect Transistor (FET) characteristics and DC biasing
   i. Junction Field Effect Transistor (JFET) transfer characteristics
   ii. DC analysis of self-bias JFET amplifier
   iii. DC analysis of voltage-divider bias JFET amplifier
   iv. Enhancement mode Metal Oxide Semiconductor Field Effect Transistor (MOSFET) bias circuits
g. AC modeling of JFET amplifiers
   i. Determination of transconductance (gm)
   ii. Analysis of common source amplifier
   iii. Analysis of common drain amplifier
   iv. Analysis of amplifier with a source resistor
   v. Study of common gate circuit
h. Cascade and cascade amplifiers
   i. DC analysis of cascade amplifiers
   ii. DC analysis of cascade amplifiers
   iii. Small-signal AC analysis of cascade and cascade amplifiers
   iv. Frequency response of an amplifier
   v. Bode plot of an amplifier. MultiSim computer analysis of frequency response of an amplifier
i. Negative feedback
   i. Concept of negative feedback
   ii. Transistor series current and series voltage feedback amplifier
   iii. Transistor shunt current and shunt voltage feedback amplifier
   iv. Miller’s theorem
j. Oscillators
   i. Concept of positive feedback
   ii. Phase-shift oscillator
   iii. Colpitts and Hartley oscillators
   iv. 555 Timer oscillator
k. Regulators
   i. Zener-shunt regulators
   ii. Fixed voltage Integrated Circuit (IC) regulator
   iii. Adjustable voltage regulator
l. Laboratory experiments
   i. Diode characteristics
   ii. Rectifiers and power supplies
   iii. Transistor characteristics
   iv. Troubleshooting amplifiers
   v. DC biasing of amplifiers
   vi. Common base amplifier
   vii. Common collector amplifier
   viii. Common emitter amplifier
   ix. DC bias FET amplifier
   x. AC analysis of FET amplifier
   xi. Cascade amplifiers
   xii. Series current and shunt voltage
   xiii. Series voltage negative feedback amplifier
   xiv. Oscillator circuits
   xv. Regulator circuits

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Resources

Albert Malvino, David Bates, and Patrick Hoppe. (2020) (2/11/2020) *Electronic Principles*, McGraw-Hill.

Robert Boylestad, and Louis Nashelsky. (2015) (10/8/2015) *Electronic Devices and Circuit Theory*, Prentice-Hall.

Charles Platt, and Fredrik Jansson. (2014) (11/13/2014) *Encyclopedia of Electronic Components*, Maker Media Inc.

James Svoboda, and Richard Dorf. (2013) (3/11/2013) *Introduction to Electric Circuits*, Wiley.

Karl Stephan. (2015) (4/6/2015) *Analog and Mixed Signal Electronics*, Wiley.

Robert Erickson, and Dragan Maksimovic. (2020) (8/16/2020) *Fundamentals of Power Electronics*, Springer.

Thomas Floyd, David Buchta, and Gary Snyder. (2019) (6/18/2019) *Electronic Fundamentals: Circuits, Devices and Applications*, Pearson.

Marcel Pelegram. (2022) (3/15/22) *Analog-to-Digital Conversion*, Springer.

Resources Other
Multisim support.

Instructional Services

OAN Number:
Transfer Assurance Guide OET005

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