

Fox Valley Technical College

10660129 Semiconductors 2

Course Outcome Summary

Course Information

Description	Introduces students to transistor operation as a switch, SCR, Triac, and Operational Amplifier operation and application.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree
Total Credits	1.00
Total Hours	27.00

Types of Instruction

Instruction Type	Credits/Hours
Lab	1 Credit/27 Hours

Course History

Revised By	Kaye Krueger (kruegek)
Last Approval Date	11/4/2014

Pre/Corequisites

Corequisite Semiconductors 1 (10-660-128)

Textbooks

Electronics Fundamentals: Circuits, Devices, and Applications
Floyd, Thomas L.; Buchla, David
Prentice-Hall
ISBN: 9780135072950
8th Edition

Employability Essentials

- 1. Act Responsibly - Apply ethical standards in both personal and professional behavior.**
Status Active
- 2. Adapt to Change - Anticipate changes and positively respond to them.**

Status Active

3. **Communicate Effectively and Respectfully - Apply appropriate writing, speaking, and listening skills across various settings to engage diverse audiences.**

Status Active

4. **Think Critically and Creatively - Apply independent and rigorous reasoning that leads to informed decisions, innovation and personal empowerment.**

Status Active

5. **Work Collaboratively - Work collaboratively with others to complete tasks, solve problems, resolve conflicts, provide information, and offer support.**

Status Active

Program Outcomes

1. **Apply electronic theory to practice.**

Type TSA Status Active

Criteria

- 1.1. You mathematically analyze a circuit or system.
- 1.2. You simulate a circuit or system.
- 1.3. You construct a circuit or system according to schematics or other documentation.
- 1.4. You perform circuit or system measurements to collect data.
- 1.5. You analyze data to validate predicted outcome.

2. **Operate test equipment.**

Type TSA Status Active

Criteria

- 2.1. You demonstrate measurement of electrical and/or electronic signals.
- 2.2. You demonstrate measurement of electrical and/or electronic quantities.
- 2.3. You demonstrate measurement of electrical and/or electronic components.
- 2.4. You use test equipment to generate electrical and/or electronic signals.
- 2.5. You apply appropriate safety precautions.

3. **Build electronic circuits and systems.**

Type TSA Status Active

Criteria

- 3.1. You assemble a prototype for operation.
- 3.2. You demonstrate soldering and de-soldering techniques.
- 3.3. You apply appropriate antistatic precautions.
- 3.4. You identify appropriate interfaces.
- 3.5. You set up programmable devices and/or systems.
- 3.6. You apply appropriate safety precautions.

4. **Evaluate the operation of electronic circuits or systems.**

Type TSA Status Active

Criteria

- 4.1. You determine the correct operation of circuits or systems.
- 4.2. You identify incorrect operation of circuits or systems.
- 4.3. You isolate causes of failures in circuits or systems.
- 4.4. You correct failures in circuits or systems.

5. **Communicate technical information.**

Type *TSA* **Status** *Active*

Criteria

- 5.1. You interpret electrical and/or electronic diagrams.
- 5.2. You create electrical and/or electronic diagrams.
- 5.3. You interpret technical reports and documents.
- 5.4. You use appropriate terminology in speaking and writing.
- 5.5. You interpret documentation of electronic devices and systems.
- 5.6. You locate necessary resources and pertinent information to perform work functions.

Course Competencies

1. Differentiate between the FET transistors

Status *Active*

Assessment Strategies

- 1.1. Written Exam

Criteria

You will know you are successful when:

- 1.1. you pass the written exam with a 70% or better.

Learning Objectives

- 1.a. Explain the basic transistor fundamentals of BJTs, FETs, MOSFETs, IGBTs.
- 1.b. Identify the schematic symbols for the BJTs, FETs, MOSFETs, IGBTs.
- 1.c. Draw the schematic symbol for n and p type transistors listed above.
- 1.d. Identify the PIN out for TO92 and TO220 packages for the transistor from a data sheet or google search.
Note: data sheet will be required for test.
- 1.e. Recognize FET terms.
- 1.f. Explain IDSS.
- 1.g. Explain VGS(OFF).
- 1.h. Explain ID.
- 1.i. Explain VGG.
- 1.j. Explain VDD.
- 1.k. Explain VP =PINCH OFF VOLTAGE.
- 1.l. Calculate current and voltage for basic switching FET circuit.
- 1.m. Determine JFET, MOSFET, IGBT operation as to conducting or nonconducting.
- 1.n. Identify block diagram for E-MOSFETs and D-MOSFETs.
- 1.o. Draw schematic symbols for the two types listed above.
- 1.p. Follow proper safety procedures when handling MOSFET and IGBT technology.
- 1.q. Apply proper bias for testing IGBTs and MOSFET transistors.
- 1.r. Calculate current and voltages in E-MOSFETs switching circuits.
- 1.s. Recognize MOSFET terms.
- 1.t. Explain VDS.
- 1.u. Explain ID.
- 1.v. Explain VGS.
- 1.w. Explain rDS(OFF).
- 1.x. Explain VGS(TH).
- 1.y. Explain VGG.
- 1.z. Explain VDD.
- 1.aa. Identify from schematic symbol n-channel and p-channel IGBTs.
- 1.bb. State which semiconductor, MOSFET or IGBT, is better used for higher frequencies.
- 1.cc. State which semiconductor, MOSFET or IGBT, is better used for higher voltage.
- 1.dd. Calculate the current and voltages for IGBTs in switching circuits.
- 1.ee. Properly bias and test an IGBT with an ohmmeter and power supply.
- 1.ff. Identify how the gate of MOSFETs and IGBTs are controlled by voltage applied to the gate and their capacitive properties.
- 1.gg. Recognize IGBT terms.
- 1.hh. Explain VCE.

- 1.ii. Explain VCE(ON).
- 1.jj. Explain IC.
- 1.kk. Explain VGE.
- 1.ll. Explain VGE(TH).
- 1.mm. Explain cutoff.
- 1.nn. Explain saturation.
- 1.oo. Review your lab experiments! Most of the information on the test has been taken from the experiments.

2. Examine the different thyristors.

Status Active

Assessment Strategies

2.1. Written Exam

Criteria

You will know you are successful when:

2.1. you pass the written exam with a 70% or better.

Learning Objectives

- 2.a. Describe the basic fundamentals of SCRs, DIACs and TRIACs.
- 2.b. Identify the schematic symbols for the SCRs, DIACs and TRIACs.
- 2.c. Draw the schematic symbol for listed above.
- 2.d. Identify the PIN out for TO220 packages for the Thyristors from a data sheet or google search. Note: data sheet will be required for test.
- 2.e. Recognize SCR terms.
- 2.f. Identify Anode.
- 2.g. Identify Cathode.
- 2.h. Identify Gate.
- 2.i. Explain Latching.
- 2.j. Explain VRRM or VDRM.
- 2.k. Explain IGT_{MN} or IGM.
- 2.l. Explain IGT.
- 2.m. Explain VGT.
- 2.n. Explain IH.
- 2.o. Explain VAK.
- 2.p. Calculate current and voltage for basic switching SCR circuit.
- 2.q. Determine SCR operation as to conducting or nonconducting.
- 2.r. Identify block transistor diagram for SCRs.
- 2.s. Follow proper safety procedures when powering SCR circuits.
- 2.t. Apply proper bias for testing SCR circuits.
- 2.u. Describe how SCRs are turned off and on.
- 2.v. Apply AC and control firing angle for SCR circuit.
- 2.w. Calculate current and voltages in DIAC circuits.
- 2.x. Recognize DIAC terms.
- 2.y. Explain VBO.
- 2.z. Explain ID.
- 2.aa. Explain VGT.
- 2.bb. Explain VP⁺.
- 2.cc. Explain VP⁻.
- 2.dd. Calculate current and voltage for basic switching of a TRIAC in a DC circuit.
- 2.ee. Determine TRIAC operation as to conducting or nonconducting.
- 2.ff. Follow proper safety procedures when powering TRIAC circuits.
- 2.gg. Apply proper bias for testing TRIAC circuits.
- 2.hh. Describe how TRIACs are turn on and off.
- 2.ii. Apply AC and control firing angle for TRIAC circuits.
- 2.jj. Recognize TRIAC terms.
- 2.kk. Explain MT1.
- 2.ll. Explain MT2.
- 2.mm. Explain Gate.
- 2.nn. Explain VDRM.

- 2.oo. Explain VRRM.
- 2.pp. Explain IGTM.
- 2.qq. Explain IGT.
- 2.rr. Explain IT(RMS).
- 2.ss. Explain IH.
- 2.tt. Explain VGG.
- 2.uu. Review your lab experiments! Most of the information on the test has been taken from the experiments.

3. Differentiate between operational amplifiers.

Status Active

Assessment Strategies

- 3.1. Written Exam

Criteria

You will know you are successful when:

- 3.1. you pass the written exam with a 70% or better.

Learning Objectives

- 3.a. Explain what is meant by inverting and non-inverting inputs.
- 3.b. Define saturation as it relates to operational amplifiers.
- 3.c. Define open and closed loop operation of operational amplifiers.
- 3.d. Explain what is meant by negative feedback.
- 3.e. Define “virtual ground” as it relates to Op Amp circuits.
- 3.f. Calculate the outputs of the following circuits given the values of resistors connected to the Op Amp and the voltages of the signals applied to the inputs :
 - 3.g. a. Comparator
 - 3.h. b. Inverting
 - 3.i. c. Non-Inverting
 - 3.j. d. Summing
 - 3.k. e. Difference
- 3.l. Use the input values in the tables in the learning objects for each circuit, and compare your results to the corresponding answers in the tables as a practice exercise.
- 3.m. List the polarity of the output produced by an Op Amp when a negative, positive, or ground potential is connected to its + or – power supply terminals.
- 3.n. List the factors that determine the type of function an Op Amp performs. List the factors that determine the amplitude of the output produced by an Op Amp.
- 3.o. Review your lab experiments! Most of the information on the test has been taken from the experiments.

Grant Award

This workforce product was funded by a grant awarded by the U.S. Department of Labor’s Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including, but not limited to, accuracy of information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

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Course Learning Plans and Performance Assessment Tasks

Type	Title	Source	Status
PAT	FET transistors	Course	Active
PAT	Thyristors	Course	Active
PAT	Operational Amplifiers	Course	Active
LP	FET transistors	Course	Active
LP	Thyristors	Course	Active
LP	Operational Amplifiers	Course	Active