

COURSE SYLLABUS



COURSE TITLE: SEMICONDUCTOR DEVICES 1
CLASS SECTION: ELEN-144-BX01
TERM: Winter 2023
COURSE CREDITS: 4
DELIVERY METHOD(S): Online

Camosun College campuses are located on the traditional territories of the Lək̓ʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.
Learn more about Camosun's [Territorial Acknowledgement](#).

For COVID-19 information please visit <https://camosun.ca/about/covid-19-updates>

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.

INSTRUCTOR DETAILS

NAME: **John Yang**
EMAIL: **yang@camosun.ca**
OFFICE: **TEC 268**
HOURS: **To Be Determined**

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

This course is an introduction to semiconductor devices. It includes such topics ranging from semiconductor theory, diodes, transistors, and thyristors, to analogs IC's including op-amps and linear regulators. The focus of this course is in the application of these devices and troubleshooting circuits containing these devices.

IN-CLASS WORKLOAD: 4 Lecture, 2 Lab for 14 weeks
OUT-OF-CLASS WORKLOAD: 6

PREREQUISITE(S): Reserved for Students Registered in the DND Program
CO-REQUISITE(S):
EXCLUSION(S):

COURSE LEARNING OUTCOMES / OBJECTIVES

- Upon completion of this course, the student will have an understanding of commonly used analog electronic components and circuits.

TEXTS AND REFERENCES

- **Electronic Devices** 5th Edition (or newer)
Floyd Thomas L. ISBN 0-13-028484-X
- **Laboratory Exercises, Handouts and Course Outline**
Typically available both online and in class

Optional Book available: (Used for ELEN 142 – Circuit Analysis)

- **Circuit Analysis with Devices** 2nd Edition (or newer)
Robbins and Miller ISBN 140187984-5

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

OUTLINE:

- 1. Diodes** (6 hrs)
 - 1.1. The conductor and insulator
 - 1.2. Doping –The semiconductor
 - 1.3. N and P type materials
 - 1.4. Biasing the PN Junction
 - 1.5. Diode characteristics
 - 1.6. Zener Diode characteristics
 - 1.7. Light-emitting diodes
 - 1.8. Photo diodes and laser diodes
 - 1.9. Schottky diodes
 - 1.10. Varactor, Tunnel and other miscellaneous diodes
 - 1.11. Varistor and other commonly used diodes
 - 1.12. Half and full wave rectifier circuits
 - 1.13. Diode Applications
- 2. Introduction to Bipolar Transistors (BJTs)** (8 hrs)
 - 2.1. BJT construction
 - 2.2. BJT operations
 - 2.3. BJT characteristics
 - 2.4. Biasing BJT's
 - 2.5. Temperature effects on biasing voltages
 - 2.6. Troubleshooting transistor bias circuits
- 3. BJT Transistor AC Amplifiers** (10 hrs)
 - 3.1. Common emitter amplifier
 - 3.2. Common collector amplifier
 - 3.3. Common base amplifier
 - 3.4. Class A amplifiers
 - 3.5. Class B amplifiers

- 3.6. Class C amplifiers
- 3.7. Types of distortion
- 4. Field Effect Transistors (FETs) (10hrs)**
 - 4.1. JFET characteristics
 - 4.2. JFET biasing
 - 4.3. JFET amplifiers
 - 4.4. D type MOSFETs
 - 4.5. E type MOSFETs
 - 4.6. MOSFET amplifiers
- 5. Amplifier Frequency Response (4 hrs)**
 - 5.1. Low Frequency Amplifier Response
 - 5.2. High Frequency Amplifier Response
 - 5.3. Total Amplifier Frequency Response
 - 5.4. Frequency Response of Multistage Amplifiers
 - 5.5. Switching characteristics
- 6. Thyristors and Unijunction Devices (6 hrs)**
 - 6.1. Introduction to thyristors
 - 6.2. Shockley diodes (or Four-layer diodes)
 - 6.3. SCR characteristics
 - 6.4. Diac's characteristics
 - 6.5. Triac's characteristics
 - 6.6. SCS, UJT, PUT, and IGBT
- 7. Oscillators (5 hrs)**
 - 7.1. Feedback Oscillators
 - 7.2. Wien bridge oscillator
 - 7.3. RC phase shift oscillator
 - 7.4. The Twin-T Oscillator
 - 7.5. Colpitts oscillator
 - 7.6. Harley and other oscillators
 - 7.7. Crystal controlled oscillators
 - 7.8. Relaxation oscillator
- 8. Unregulated and Regulated Power Supplies (5 hrs)**
 - 8.1. Zener regulator
 - 8.2. Emitter follower regulator
 - 8.3. Variable feedback regulator
 - 8.4. Linear and Switching regulator
 - 8.5. Other IC regulators
 - 8.6. Basic power supply design
 - 8.7. Determining power supply component values

Midterm (2 hrs)

(Total In-Class Theory Hours *: 56 hours)

** including quizzes, Midterm exam, and review time*

LABORATORY EXERCISES

There will be 13 lab exercises to be completed, one per week of the semester. Each exercise will be of 2 hours duration and all must be completed satisfactorily in order to gain a credit for ELEN 144. Labs will be available on D2L on Monday every week. Preparation must be completed by the student before the start of the lab.

(Online Version)

Lab 01	Get Ready for Online Labs with MULTISIM
Lab 02	Introduction to Diodes and Diode Characteristics
Lab 03	Clippers (Limiters) and Clampers
Lab 04	Zener Diodes and Their Characteristics
Lab 05	Introduction to Bipolar Junction Transistors (BJTs)
Lab 06	A Simple DC-biased BJT Amplifier Design
Lab 07	Voltage-divider Biased BJT Circuits
Lab 08	BJT ac Amplifiers
Lab 09	Introduction to Junction Field-Effect Transistor (JFET)
Lab 10	JFET Amplifiers Design
Lab 11	Introduction to Thyristors Circuits
Lab 12	Oscillator Circuits
Lab 13	Introduction to Voltage Regulation Circuits

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced noticed is required. Deadlines scan be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Quizzes	5%
Assignments	15%
Labs	20%
Midterm Exam	20%
Final Exam	40%
	TOTAL
	100%

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information.
<http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

COURSE GUIDELINES & EXPECTATIONS

- Students must obtain a minimum weighted average of 60% in theory evaluations (tests, examinations etc.) in any course that is a pre-requisite for subsequent courses.
- Students must obtain a minimum weighted average of 60% in lab evaluations (lab performance, reports, etc.) in any course that is a pre-requisite for subsequent courses.
- Students must obtain a minimum of 50% on the final examination for a course in order to receive a passing grade.
- Failure to meet any one of these criteria will result in a student receiving a failing grade for the course.
- All assignments (laboratory work, reports, etc.) must be submitted prior to a student writing a final examination. ALL assignments must be submitted in order to qualify to write a final exam.
- Late assignments will have marks deducted; if handed in after assignments are returned to the class, then no mark will be awarded, but the assignment must be submitted.

SCHOOL OR DEPARTMENTAL INFORMATION

- [Electronics and Computer Engineering Department \(link\)](#)
- [School of Trades & Technology \(link\)](#)

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit <http://camosun.ca/students/>.

Support Service	Website
Academic Advising	http://camosun.ca/advising
Accessible Learning	http://camosun.ca/accessible-learning
Counselling	http://camosun.ca/counselling
Career Services	http://camosun.ca/coop
Financial Aid and Awards	http://camosun.ca/financialaid
Help Centres (Math/English/Science)	http://camosun.ca/help-centres
Indigenous Student Support	http://camosun.ca/indigenous
International Student Support	http://camosun.ca/international/
Learning Skills	http://camosun.ca/learningskills
Library	http://camosun.ca/services/library/
Office of Student Support	http://camosun.ca/oss
Ombudsperson	http://camosun.ca/ombuds
Registration	http://camosun.ca/registration
Technology Support	http://camosun.ca/its
Writing Centre	http://camosun.ca/writing-centre

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc). If you have a disability, the [Centre for Accessible Learning](#) (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course

instructors. Please visit the CAL website for contacts and to learn how to get started:

<http://camosun.ca/services/accessible-learning/>

Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the "Attendance" section under "Registration Policies and Procedures" (<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal. Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.8.pdf> to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence and Misconduct

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence or misconduct occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them

understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence and Misconduct Policy: <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.9.pdf> and camosun.ca/sexual-violence. To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-3703841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College's Student Misconduct Policy at <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

Changes to this Syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.