COURSE SYLLABUS

COURSE TITLE: ELEN 144 Semiconductor Devices

CLASS SECTION: DX01 (Serial 2 AT1)

TERM: Summer

COURSE CREDITS: 4

DELIVERY METHOD(S): Online

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

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.

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: Landon Brown

EMAIL: BrownLa@camosun.ca

OFFICE: TEC 215

HOURS: 4 lecture, 2 lab.

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.

PREREQUISITE(S): ELEN 142
CO-REQUISITE(S):
EQUIVALENCIES:

COURSE LEARNING OUTCOMES / OBJECTIVES

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

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*

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

Electronic Devices – Floyd (5th edition)

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.

ELEN-144 Semiconductor Devices - Summer 2023 Schedule

Week	Day	Time	Lecture	Problem Set	Quizzes
1	Mon.	9:30	**Course Outline & Intro**		**Quiz #1** (Ch 1 - Intro) Due: **May 12th**
	Tues.	12:30	**Diodes** (1 / 6)		
	Wed.	8:30	**Diodes** (3 / 6)		
	Fri. Lab	14:30	***Learn to use MULTISIM***		
2	Mon.	9:30	**Diodes** (4 / 6)		**Quiz #2** (Ch 2 & 3 - Diodes) Due: **May 19th**
	Tues.	12:30	**Diodes** (5 / 6)		
	Wed.	8:30	**Intro to BJT's** (1 / 8)		
	Fri. Lab	14:30	***Diodes & Diode Characteristics***		
3	Mon.	9:30	**Intro to BJT's** (2 / 8)	**Problem Set #1** Due: **May 21st**	**Quiz #3** (Ch 4 - BJT's) Due: **May 26th**
	Tues.	12:30	**Intro to BJT's** (3 / 8)		
	Wed.	8:30	**Intro to BJT's** (5 / 8)		
	Fri. Lab	14:30	***Clippers & Clampers***		
4	Mon.	9:30	**Victoria Day (College Closed)**		**Quiz #4** (Ch 5 - BJT Bias) Due: **June 2nd**
	Tues.	12:30	**Intro to BJT's** (7 / 8)		
	Wed.	8:30	**Intro to BJT's** (8 / 8)		
	Fri. Lab	14:30	***Zener Diodes & Characteristics***		
5	Mon.	9:30	**BJT AC Amplifiers** (2 / 10)	Problem Set #2 Due: **June 4th**	
	Tues.	12:30	**BJT AC Amplifiers** (3 / 10)		
	Wed.	8:30	**BJT AC Amplifiers** (5 / 10)		
	Fri. Lab	14:30	***Intro to BJT's***		
6	Mon.	9:30	**BJT AC Amplifiers** (6 / 10)		**Quiz #5** (Ch 6 - BJT Bias) Due: **June 16th**
	Tues.	12:30	**BJT AC Amplifiers** (7 / 10)		
	Wed.	8:30	**BJT AC Amplifiers** (9 / 10)		
	Fri. Lab	14:30	***DC-Biased BJT Ampllifer***		
7	Mon.	9:30	**BJT AC Amplifiers** (10 / 10)		**Quiz #6** (Ch 7 - Power Amp) Due: **June 23rd**
	Tues.	12:30	**Field Effect Transistors (FETs)** (1 / 10)		
	Wed.	8:30	**Field Effect Transistors (FETs)** (3 / 10)		
	Fri. Lab	14:30	***Voltage-Divider Biased BJT Amplifier***		
8	Mon.	9:30	**Field Effect Transistors (FETs)** (4 / 10)	**Problem Set #3** Due: **June 25th**	**Midterm (up to BJT amps)**
	Tues.	12:30	**Field Effect Transistors (FETs)** (5 / 10)		
	Wed.	8:30	**Field Effect Transistors (FETs)** (7 / 10)		
	Fri. Lab	14:30	***Midterm***		
9	Mon.	9:30	**Field Effect Transistors (FETs)** (8 / 10)		**Quiz #7** (Ch 8 -FETs) Due: **July 7th**
	Tues.	12:30	**Field Effect Transistors (FETs)** (9 / 10)		
	Wed.	8:30	**Amp. Frequency Response** (1 / 4)		
	Fri. Lab	14:30	***BJT AC Amplifier***		

10	Mon.	9:30	**College Closed**		
	Tues.	12:30	**Amp. Frequency Response** (3 / 4)		
	Wed.	8:30	**Amp. Frequency Response** (4 / 4)		
	Fri. Lab	14:30	***Junction Field-Effect Transistor (JFET)***		
11	Mon.	9:30	**Thyristors & Unijunction Devices** (1 / 6)		**Quiz #8** (Ch 11 - Thyristors) Due: **July 7th**
	Tues.	12:30	**Thyristors & Unijunction Devices** (2 / 6)		
	Wed.	8:30	**Thyristors & Unijunction Devices** (4 / 6)		
	Fri. Lab	14:30	***JFET Amplifier Design***		
12	Mon.	9:30	**Thyristors & Unijunction Devices** (5 / 6)		
	Tues.	12:30	**Thyristors & Unijunction Devices** (6 / 6)		
	Wed.	8:30	**Oscillators** (1 / 5)		
	Fri. Lab	14:30	***Intro to Thyristor Circuits***		
13	Mon.	9:30	**Oscillators** (2 / 5)	**Problem Set #4** Due: **July 30th**	
	Tues.	12:30	**Oscillators** (3 / 5)		
	Wed.	8:30	**Oscillators** (5 / 5)		
	Fri. Lab	14:30	***Oscillator Circuits***		
14	Mon.	9:30	Course Review & Practice Problems		
	Tues.	12:30	Course Review & Practice Problems		
	Wed.	8:30	Course Review & Practice Problems		
	Fri. Lab	14:30	**Review**		

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 can be reviewed on the CAL exams page. 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 policy for more information. http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf

COURSE GUIDELINES & EXPECTATIONS

A minimum of 60% overall mark must be achieved in both the theory and lab portions to pass the course. Less than 60% overall mark in either portion will result in a failure of the entire course. In addition, to pass the course, the final examination mark must be not less than 50%.

The final grading is based on 80% of theory work, and 20% of lab evaluation. Lab evaluation will be based on completing all assigned exercises and lab reports. Labs are to be completed within the assigned lab period and evaluated as satisfactory or unsatisfactory. Any unsatisfactory lab reports must be redone until a satisfactory level is achieved.

Attendance and completion of all lab material is mandatory to complete the course. Attendance at all tutorials is also compulsory.

Quizzes may be given at any time without prior notice and will be based on the current class notes, example problems and any textbook reading assigned.

SCHOOL OR DEPARTMENTAL INFORMATION

Electronics & Computer Engineering Technology
Chair: John Yang

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

Support Service	Website
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 Integrity

Students are expected to comply with all College policy regarding academic integrity; which is about honest and ethical behaviour in your education journey. The following guide is designed to help you understand your responsibilities: https://camosun.libguides.com/academicintegrity/welcome
Please visit http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf for Camosun's Academic Integrity policy and details for addressing and resolving matters of academic misconduct.

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 Progress

Please visit https://www.camosun.ca/sites/default/files/2021-05/e-1.1_0.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" (https://camosun.ca/registration-records/policies-and-procedures-students/registration-policies-students) 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://www.camosun.ca/sites/default/files/2021-05/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 250-370-3841

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.

Looking for other policies?

The full suite of College policies and directives can be found here: https://camosun.ca/about/camosun-college-policies-and-directives

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.