

# COURSE SYLLABUS



COURSE TITLE: ECET 220  
CLASS SECTION: X01A X01B  
TERM: Winter 2024  
COURSE CREDITS:  
DELIVERY METHOD(S): Face to Face

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

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*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

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NAME: Todd Rayson  
EMAIL: raysont@camosun.ca  
OFFICE: TEC 214, 250 370 - 4573  
HOURS: By Appointment

*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 barriers that impede success.*

## CALENDAR DESCRIPTION

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PREREQUISITE(S): C in ECET 242  
CO-REQUISITE(S): N/A  
EXCLUSION(S): N/A

Students will focus on power devices and power systems for renewable energy. They will study three-phase power, the “smart grid,” DC and AC motors and generators, power devices such as IGBTs and thyristors, DC-DC converters, inverters, controlled rectifiers, and DC and AC motor drives. Students will apply this to wind and solar energy systems and electric cars.

***Upon successful completion of this course a student will be able to:***

- ✓ Describe the characteristics and operation of power control devices
- ✓ Draw the characteristic curves of power control devices
- ✓ Classify power devices according to speed, power and control type
- ✓ Interpret power device specifications and specify power devices for a given application
- ✓ Calculate power device losses and heat-sink requirements
- ✓ Explain the fundamental concepts of three phase power systems and grid-tying
- ✓ Perform calculations to determine voltage, current and power values of three phase power systems
- ✓ Describe the operation of AC and DC motors/generators
- ✓ Perform basic calculations for AC and DC motors and generators
- ✓ Describe the operation of inverter circuits
- ✓ Describe the operation of controlled rectifier circuits
- ✓ Describe the operation of circuits involving power diodes, thyristors and controlled switches
- ✓ Describe the operation of DC and AC motor drives
- ✓ Outline strategies for power device protection and isolation
- ✓ Draw waveforms for industrial electronics circuits
- ✓ Perform calculations to determine suitable component values for power circuits
- ✓ Explain the operation of control circuits for power control devices
- ✓ Apply a DC-DC converter for maximum power point tracking (MPPT)
- ✓ Explain the use of chopper circuits and inverters
- ✓ Outline the use of an H-bridge circuit in regenerative systems



## Course Content and Schedule (Subject to change)

<b>1.</b>	<b>Introduction</b>	<b>5 hours</b>
1.1	The power grid and three-phase systems	
1.2	Grid components	
1.3	Three-phase calculations	
1.4	Distributed vs. centralized renewable energy supply	
1.5	The “smart grid”	
<b>2.</b>	<b>DC motors and generators</b>	<b>3 hours</b>
2.1	Electromagnetics review	
2.2	Electric machine physical construction	
2.3	Series, shunt and compound wiring	
<b>3.</b>	<b>AC generators</b>	<b>3 hours</b>
3.1	Three-phase induction generators	
3.2	Three-phase synchronous generators	
3.3	Grid synch and grid tie for wind energy applications	
<b>4.</b>	<b>AC motors</b>	<b>3 hours</b>
4.1	Three-phase induction motors	
4.2	Three-phase synchronous motors	
4.3	Single-phase motors	
<b>5.</b>	<b>Power electronics</b>	<b>3 hours</b>
5.1	Basic concepts	
5.2	Power devices	
5.2.1	Power diodes	
5.2.3	Controlled switches: BJT, MOSFET, IGBT	
5.3	Switching characteristics and snubbers	
5.4	Drive circuits and isolation	
<b>6.</b>	<b>DC-DC converters</b>	<b>3 hours</b>
6.1	Buck, boost and buck-boost	
6.2	Application to PV charging systems	
6.3	Maximum power point tracking (MPPT)	
<b>7.</b>	<b>Inverters and AC motor drives</b>	<b>3 hours</b>
7.1	Single-phase inverters	
7.2	Three-phase inverters	
7.3	Three-phase and PM DC motor control application	
7.4	Use of inverters in grid-tied PV systems	
<b>8.</b>	<b>DC motor drives</b>	<b>3 hours</b>
8.1	Basic “chopper” circuit	
8.2	Half bridge	
8.3	Full H bridge	
8.4	Regenerative systems	
<b>9.</b>	<b>Thyristor power devices</b>	<b>3 hours</b>
9.1	Thyristor devices (SCR, TRIAC, DIAC, GTO)	
9.2	Solid-state relays	
<b>10.</b>	<b>Controlled rectifiers</b>	<b>3 hours</b>
10.1	Operation of controlled rectifiers	
10.2	DC motor control applications	

<b>11. Renewable energy (RE) systems</b>	<b>3 hours</b>
11.1 Further applications of power electronics in RE	
11.2 Case studies <sup>1</sup>	
<b>12. Series/parallel devices</b>	<b>1 hour</b>
<b>13. Thermal considerations</b>	<b>1 hour</b>
Tests	<b>7 hours</b>
<b>Total</b>	<b>42 hours</b>

### **Lab Topics (Subject to Change)**

- Introduction to Lab-Volt (equipment use, lab safety, power theory review)
- Three phase systems (Lab-Volt)
- DC motor (Lab-Volt)
- AC generator/motor (Lab-Volt)
- Reverse recovery time of diodes
- PWM choppers and IGBTs
- DC-DC converters
- H-bridge motor control
- SCR motor control
- Solid state relay
- TRIAC/DIAC control

## EVALUATION OF LEARNING

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The final course grade will be determined by the following components:

DESCRIPTION	WEIGHTING %
Midterms	20
Labs	35
Final Exam	45
<b>TOTAL</b>	<b>100%</b>

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-) policy for more information.  
<http://camosun.ca/about/policies/education-academic/e-1-programming-and->

*Note: During the course you are responsible for putting all equipment away and keeping your area and the lab tidy. If there is broken or malfunctioning equipment, you are responsible for reporting it.*

## COURSE GUIDELINES & EXPECTATIONS

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- Attendance to all labs is **mandatory**
- 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 project** 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 (F) for the course
- Mark penalties of 50% and 5% per day will be applied to all **late labs** and assignments
  - All course material must be handed in or you will receive an incomplete ('I') in the course
  - All course material must be handed in by the end of the last class
- A 20% penalty will be applied to the current lab mark for **late lab attendance**
  - Being late for the lab disrupts the entire lab group
  - Many important lab related topics are discussed at the beginning of the lab
- Pre-Lab work is very important. At a **minimum** you need to read the lab thoughtfully. Other pre-Lab calculations and work may be required. Failure to complete your pre-lab is a loss of 20% for the current lab.

## SCHOOL OR DEPARTMENTAL INFORMATION

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See the Trades and Tech, Electronics web page  
ECET 220

## STUDENT RESPONSIBILITY

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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

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

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

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### 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](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](http://camosun.ca/sexual-violence). To contact the Office of Student Support: [oss@camosun.ca](mailto: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.