

COURSE SYLLABUS



COURSE TITLE: **CIRCUIT ANALYSIS**
CLASS SECTION: **ELEN-142-BX01**
TERM: **Winter 2023**
COURSE CREDITS: **4**
DELIVERY METHOD(S): **Hybrid (lectures online, labs in person)**

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

For COVID-19 information please visit <https://legacy.camosun.ca/covid19/index.html>.

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 introduces students to concepts of circuit analysis for AC and DC circuits. Topics include: fundamental electrical quantities, series and parallel circuits, network analysis and theorems, resistance, capacitance and inductance. Instruments, instrumentation and troubleshooting concepts are introduced. Use is made of complex numbers and phasor diagrams to explain the operation of AC circuits.

IN-CLASS WORKLOAD: 4 lecture, 1 tutorial, 2 lab
OUT-OF-CLASS WORKLOAD: 4

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

- Upon completion of this course the student will have a complete understanding of DC and AC circuit operation, including the analysis of circuits containing capacitors and inductors.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

- COURSE TEXT** - **Principles of Electric Circuits**
 Thomas L Floyd ISBN 13-9780135073094
- (or) - **Introduction to Circuit Analysis**
 Walls Johnstone ISBN 0-314-93386-7
- (or) - **Circuit Analysis with Devices** 2nd Edition (or newer)
 Robbins and Miller ISBN 140187984-5
- **Laboratory Exercises, Handouts and Course Outline**

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.

<u>OUTLINE</u>	<u>Estimated Time</u>
1. <u>Introduction (review)</u>	(1 hour)
1.1 SI Units	
1.2 Scientific Notation and Engineering Notation	
2. <u>Nature of Electricity (review)</u>	(1 hour)
2.1 Theory of Electrical Charge	
2.2 Structure of the Atom	
2.2.1 Bohr's Model and Structure of atoms and ions	
2.2.2 States of Matter and Bonding	
2.3 Conductors, Insulators and Semi-Conductors	
2.4 Conventional versus Electron Current Flow	
2.5 Definition of the Coulomb, Ampere, Volt and Ohm	
3. <u>Resistance</u>	(3 hours)
3.1 Types of Resistors including Linear Resistors and Non-Linear Resistors	
3.2 Resistor Color Code	
3.3 Ohm's and Watt's Law	
3.4 Work, Energy, Power in Resistive Circuits	
4. <u>Resistive Networks and Simple Circuit Analysis</u>	(7 hours)
4.1 Series Circuits	
4.2 Kirchhoff's Voltage Law (KVL)	

- 4.3 Voltage Divider Rule
- 4.4 Parallel Circuits
- 4.5 Kirchhoff's Current Law (KCL)
- 4.6 Current Divider Rule
- 4.7 Series - Parallel Circuits
- 4.8 The Voltage Divider – two resistors, a potentiometer
- 4.9 Voltmeter, Ammeter, Ohmmeter and other DC Measuring Instruments
- 4.10 Wheatstone Bridge Circuit
- 4.11 Delta - Wye Conversions

- 5. Circuit Analysis using Basic Network Theorems (9 hours)
 - 5.1 Equivalent Circuits
 - 5.2 Constant Voltage Sources
 - 5.3 Practical Voltage Sources
 - 5.4 Internal Resistance
 - 5.5 Constant Current Sources
 - 5.6 Current Sources in Parallel and Series
 - 5.7 Maximum Power Transfer Theorem
 - 5.8 Thevenin's Theorem
 - 5.9 Norton's Theorem* (optional)
 - 5.10 Superposition Theorem
 - 5.11 Mesh Current Analysis

- 6. Capacitance (2 hours)
 - 6.1 Electric Fields
 - 6.2 Electrostatic Induction
 - 6.3 Dielectrics
 - 6.4 Capacitance
 - 6.5 Capacitors in Series
 - 6.6 Capacitors in Parallel

- 7. Capacitance in DC Circuits (7 hours)
 - 7.1 Charging/Discharging
 - 7.2 Time Constant
 - 7.3 Stored Energy
 - 7.4 Capacitor Response to step and rectangular inputs
 - 7.5 Capacitor as an Integrator and Differentiator

- 8. Inductance (2 hours)
 - 8.1 Electromagnetic Inductance
 - 8.2 Faraday's Law
 - 8.3 Lenz's Law
 - 8.4 Self-Inductance
 - 8.5 Inductors in Series
 - 8.6 Inductors in Parallel

- 9. Inductance in DC CIRCUITS (4 hours)
 - 9.1 Rise/Fall of Current in an RL Circuit
 - 9.2 Time Constant

9.3	Stored Energy	
9.4	RL Circuit Response to a Step input	
10.	<u>Introduction to Alternating Current</u>	(4 hours)
10.1	Sine Wave Generation and Phase Relationships	
10.2	Period, Frequency and Phasor Representations of Sine Waves	
10.3	Purely Resistive AC Circuits	
10.4	Peak, Average, and Effective (RMS) Value of A Sine Wave	
10.5	Other Types of Periodic Waveforms	
11.	<u>Capacitance in AC Circuits</u>	(5 hours)
11.1	Capacitive Reactance	
11.2	Analysis of Series RC Circuits	
11.3	Analysis of Parallel RC Circuits	
11.4	Power in a Capacitive Circuit	
12.	<u>Inductance in AC Circuits</u>	(5 hours)
12.1	Inductive Reactance	
12.2	Analysis of Series RL Circuits	
12.3	Analysis of Parallel RL Circuits	
12.4	Power in an Inductive Circuit	
13.	<u>Non Resonant AC Circuits</u>	(4 hours)
13.1	Analysis of Series RLC Circuits	
13.2	Analysis of Parallel RLC Circuits	
13.3	Power in an RLC Circuit	
14.	<u>Resonant AC Circuits</u>	(6 hours)
14.1	Series Resonance	
14.2	Quality Factor & Selectivity in A Series Resonant Circuit	
14.3	Parallel Resonance	
14.4	Quality Factor & Selectivity in A Parallel Resonant Circuit	
15.	<u>Transformers</u>	(4 hours)
15.1	Theory of Operation - Mutual Inductance	
15.2	Iron, Air, and Ferrite Core Transformers	
15.3	Voltage and Current Ratios	
15.4	Reflected Impedance	
15.5	Transformer Losses	
16.	<u>Filters</u>	(6 hours)
16.1	Low Pass Filters	
16.2	High Pass Filters	
16.3	Gain, Attenuation, Decibel, Decade, and Octave	
16.4	Normalized Frequency Response Curves vs. Bode-plots	
16.5	Band Pass Filters	
16.6	Band Reject Filters (or Notch Filters)	
	Total In-Class Theory Hours <i>(including quizzes, term exams)</i>	70 hours

LABORATORY EXERCISES

There will be a total of 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 142. All labs will be handed out during class in the week prior to the exercise and preparation must be completed by the student before the start of the lab.

1. Introduction to Multisim Software to ELEN-142
2. Breadboards, Resistors and Simple Circuit Construction
3. Simple Series Circuit and Voltage Divider
4. Parallel and Series-Parallel Circuits in DC
5. DC Network Theorems
6. DC Capacitive Circuits
7. DC Inductive Circuits
8. Introduction to AC Measurements
9. AC Measurements in a Series RC Circuit
10. Amplitude, Phase Angle and Power in a Series AC Circuit
11. AC Non-Resonant RLC Circuits
12. AC Resonant RLC Circuits
13. Transformer Characteristics
14. Filters

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 notice is required. Deadlines can 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
Assignments/Quizzes	15%
Labs	15%
Term Test 1	15%
Term Test 2	15%
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.
- 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 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/>.

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.