COURSE SYLLABUS

CAMOSUN COLLEGE

COURSE TITLE:	ELEN 181
CLASS SECTION:	Pulse Techniques
TERM:	Summer 2023
COURSE CREDITS:	3
DELIVERY METHOD(S):	In Person

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:	John Yang
EMAIL:	yang@camosun.ca
OFFICE:	TEC 268
HOURS:	Refer to Timetable

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 the student to non-sinusoidal waveforms. Emphasis is placed on the use of integrated circuits to generate these waveforms. The operation of comparator circuits, switching circuits and timers will be investigated. Appropriate laboratory exercises will support investigation of these circuits.

PREREQUISITE(S):	**Reserved for DND WENG program**
CO-REQUISITE(S):	
EQUIVALENCIES:	

COURSE LEARNING OUTCOMES / OBJECTIVES

- Apply pulse fundamentals.
- Explain the principles of capacitive-resistive circuits.
- Explain the principles of diode switching.
- Explain the principles of transistor switching.
- Explain the principles of IC operational amplifiers in switching circuits.
- Explain the principles of Schmitt trigger circuits (op amp only) and voltage comparators.
- Explain the principles of IC timer circuits.
- Explain the principles of ramp generators.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

- **"Solid State Pulse Circuits"** by David A. Bell **(Required)**
- Lecture Notes, handouts, Labs, and Assignments
- **"Introduction to Circuit Analysis"** by Walls and Johnstone **(Optional)**

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.

CREDIT:	3
IN-CLASS WORKLOAD:	2 hours lecture, 2 hours lab
OUT-OF-CLASS WORKLOAD:	2 hours
PREREQUISITES:	Reserved for DND students

OUTLINE

1. DC Theory Review *(Week 1-2 plus Lab Lecture)*

A. Resistor color code, SI units and prefixes
B. Ohm's law
C. Series resistive circuits
D. Voltage divider rule
E. Parallel resistive circuits
F. Current divider rule
G. Kirchhoff's voltage and current rules
H. Superposition theorem* (optional)
I. Thevenin's theorem
J. Maximum Power Transfer Theorem
K. Mesh current method* (optional)

2. Waveform Fundamentals *(Week 3-4)*

Types of Waveforms

    A. AC Waveform Fundamentals
    B. Repetitive waveforms
    C. Transients
    D. Sinusoidal waveforms
    E. Rectangular waveforms
    F. Ramp waveforms
    G. Triangular waveforms
    H. Sawtooth waveforms
    I. Exponential waveforms
    J. Spikes

Waveform Calculations

    A. Average value of a rectangular and sawtooth waveform
    B. Effective values (DC) of rectangular and sawtooth waveforms
    C. Ramp voltages
    D. The period given the slope of a ramp
    E. Average and effective values of ramp waveforms
    F. Exponential voltages
    G. Rectangular waveforms
    H. Duty cycle of a rectangular waveform

The Ideal Pulse Waveform

    A. Leading edge, rising edge, positive going edge
    B. Trailing edge, falling edge, negative-going edge
    C. Pulse width, PW, pulse duration, mark length
    D. Pulse repetition frequency (PRF)
    E. Space width
    F. Duty cycle, mark to space ratio
    G. Rise time
    H. Fall time
    I. Tilt
    J. Ideal Waveform
    K. Practical waveform

Harmonic Content of Waveforms

    A. Frequency synthesis
    B. Harmonic Analysis [Square waveform, Rectangular waveform (Pulse train)]

Waveform Distortion

    A. High frequency distortion
    B. Low frequency distortion
    C. Low and high frequency distortion
    D. Overemphasis of high frequencies (ringing)

3. Resistive-Capacitive (RC) Circuits *(Week 4-6)*

Capacitor Charging
- A. How capacitors charge and discharge
- B. Time constant

Universal Time Constant Curves
- A. Finding charge and discharge times using normalized curve
- B. Rise time and fall time relationships

RC Circuit response to Square Waves
- A. Integrator
- B. Differentiator

4. Diode Switching Circuits *(Week 7-8)*

- A. Review of diode operation
- B. Diode Clipper circuits
- C. Diode Clamper circuits
- D. Voltage multipliers

5. Transistor Switching *(Week 8-9)*

- A. Review of transistor operation
- B. The transistor switch
- C. Speed-up capacitor
- D. The transistor inverter

6. IC Operational Amplifiers *(Week 10-11)*

Op-Amp basics
- A. Linear non-inverting amplifier
- B. Linear inverting amplifier
- C. Voltage follower
- D. Summing network
- E. The op-amp integrator and differentiator

Op-amps in switching
- A. Logic inverter
- B. Clipper

7. Schmitt Trigger Circuit *(Week 11-12)*

    A. Schmitt trigger basics
    B. Op Amp comparator circuit
    C. Op-Amp Schmitt Trigger circuit
    D. The IC Schmitt Trigger circuit

8. Multivibrator Circuits *(Week 12-13 plus Lab Lecture)*

Monostable multivibrator
    A. Intro to multivibrators
    B. Waveforms for the monostable multivibrator
    C. Emitter coupled monostable multivibrator
    D. Op-amp monostable multivibrator
    E. IC monostable multivibrator
    F. Applications of the monostable multivibrator – 555 Timer

Astable multivibrator
    A. Waveforms for the transistor astable multivibrator
    B. Calculating frequency of the output
    C. Symmetrical and asymmetrical outputs for the transistor astable
    D. Op-amp astable multivibrator
    E. Applications of the astable multivibrator – 555 Free Running Oscillator
    F. Synchronizing the astable multivibrator

Bistable multivibrator

9. Ramp Generators *(Week 14)*

    A. Desirable characteristics of a ramp generator
    B. RC ramp generator
    C. Constant current ramp generators
    D. Bootstrap ramp generator
    E. Free-Running ramp generator
    F. Miller integrator ramp generator
    G. Pulse generator circuit
    H. Function generators

Lab 1:   The Breadboard and Resistors in Series *(or Lecture)*

Lab 2:   Parallel and Series-Parallel Resistive Circuits

Lab 3:   DC Network Theorems

Lab 4:   AC Waveform Fundamentals

Lab 5:   Capacitor Charging Circuits

Lab 6:   Effects of Resistors and Capacitors on Pulses

Lab 7:   Diode Circuits

Lab 8:   Transistor Switching

Lab 9:   OP-AMP Application Circuits I

Lab 10:   OP-AMP Application Circuits II

Lab 11:   555 Timer

Lab 12:   Ramp Generator I

Lab 13:   Ramp Generator II

Lab 14:   Make-up session

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

Assignments (4)	10%
Quizzes (5)	5%
Term Tests (2)	30%
Final Exam	40%
Total theory	**85%**
Laboratory Evaluation	15%
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 passing grade must meet following three criteria:
1) Overall lab mark is equal to or greater than 60%;
2) Overall theoretical mark (assignments, tests, final exam) is equal to or greater than 60%;
3) The final exam mark is equal to or greater than 50%.

The following criteria must be met:
- 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
  (https://camosun.ca/programs-courses/find-program/electrical-engineering-technology-marine-industrial-diploma#faculty)

- School of Trades & Technology
  (https://camosun.ca/programs-courses/school-trades-technology)

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.

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.