

COURSE SYLLABUS



COURSE TITLE: ECET 236 Discrete Structures in Engineering

CLASS SECTION: X01A

TERM: 2023F

COURSE CREDITS: 3

DELIVERY METHOD(S): 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 [Territorial Acknowledgement](#).

The COVID-19 pandemic has presented many challenges, and Camosun College is committed to helping you safely complete your education. Following guidelines from the Provincial Health Officer, WorkSafe BC, and the B.C. Government to ensure the health and wellbeing of students and employees, Camosun College is providing you with every possible protection to keep you safe. Our measures include COVID Training for students and employees, health checks, infection control protocols including sanitization of spaces, PPE and ensuring physical distancing. For details on these precautions please follow this link: <http://camosun.ca/covid19/faq/covid-fags-students.html>. However, if you're at all uncomfortable being on campus, please share your concerns with your Instructor. If needed, alternatives will be discussed.

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: Joyce van de Vegte

EMAIL: vandevogte@camosun.ca

OFFICE: TEC 208

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

Students will study the use of recurrence relations and generating functions in engineering problems, as well as engineering modeling with graphs, graph representation and traversal techniques, and their computational complexity. Use of branch-and-bound, divide-and-conquer, greedy, network flow, dynamic programming, approximation, and heuristic combinatorial algorithms in electrical and computer engineering applications will be covered.

PREREQUISITE(S): C in MATH 250A, C in MATH 251

COURSE LEARNING OUTCOMES / OBJECTIVES

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

- Apply basic discrete structures to model and analyze electrical and computer engineering problems.
- Use and manipulate recurrence relations arising in electrical and computer engineering applications (e.g., digital signal processing, digital control).
- Use and manipulate generating functions arising in computer and electrical engineering applications (e.g., digital control, digital communication).
- Formulate certain electrical and computer engineering problems as graph problems (e.g., electric circuits, computer networks).
- Use and evaluate basic combinatorial algorithms arising in electrical and computer engineering applications (e.g., digital communication, electric circuits, embedded systems).

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

Class notes and resources will be available on D2L.

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.

HOURS	ACTIVITY or TOPIC
0.5	1. Introduction
3.5	2. Functions 2.1 Sets 2.1.1 Special sets 2.1.2 Subsets 2.1.3 Operations on sets 2.1.4 Algebraic rules for sets 2.1.5 Partitions 2.1.6 Cartesian products 2.2 Functions as mappings from one set to another 2.3 Special types of functions 2.3.1 Surjection, injection and bijection 2.3.2 Identity 2.4 Binary operations 2.4.1 Definition of binary operation 2.4.2 Identities and inverses 2.5 Operators 2.6 Asymptotic bounds 2.6.1 Asymptotic complexity 2.6.2 Polynomial and exponential time
1.5	3. Relations 3.1 Binary relations 3.2 Relations on a set

HOURS	ACTIVITY or TOPIC
	3.3 Partial orderings 3.4 Equivalence relations
3	4. Integers modulo m 4.1 Definition and structure 4.2 Modular arithmetic operations 4.3 Additive and multiplicative inverses 4.4 Euclid's algorithm for computing greatest common divisor (GCD) and mod inverse 4.5 Congruence and congruence equations 4.6 Chinese remainder theorem
4	5. Graphs 5.1 Digraphs 5.2 Graphical representation of relations 5.3 Graph terminology and representation 5.4 Cycle detection 5.5 Dijkstra's algorithm 5.6 Bellman-Ford algorithm 5.7 Undirected graphs 5.8 Trees and spanning trees 5.9 Minimum-cost spanning trees 5.9.1 Kruskal's algorithm 5.9.2 Prim's algorithm 5.10 Greedy methods 5.11 Searching graphs and digraphs 5.11.1 Breadth-first search 5.11.2 Depth-first search
7	6. Linear programming 6.1 Standard forms 6.2 Feasible and optimal solutions 6.3 Integer linear programming 6.3.1 Maximum network flow problem 6.3.2 Minimum-cost flow problem 6.3.3 Knapsack problem 6.3.3.1 Greedy heuristic 6.3.3.2 Branch-and-bound 6.3.3.3 Dynamic programming 6.4 Divide-and-conquer 6.4.1 n -bit integer multiplication 6.4.2 Computation of Fast Fourier transform (FFT) 6.4.3 Wavelet transform
6	7. Recursions 7.1 Groups 7.2 Fields 7.3 Rings 7.4 Polynomials 7.5 Power series 7.6 Multiplicative inverse of polynomials and power series

HOURS	ACTIVITY or TOPIC
	7.7 Ordinary generating functions 7.8 Homogeneous linear recursions (HLR) 7.8.1 Solution by OGFs and partial fractions 7.8.2 Solution by characteristic roots 7.9 Nonhomogeneous linear recursions (NHLR) 7.9.1 Solution by homogeneous and particular solutions 7.9.2 Solution by generating functions
7.5	8. Applications of recursions 8.1 Linear shift registers 8.1.1 Feedforward and feedback shift registers 8.1.2 Transfer functions 8.1.3 Simplify rational functions using Euclid's algorithm 8.2 State space representation for linear MIMO machines 8.3 Discrete time linear systems 8.3.1 Difference equation 8.3.2 Transfer function 8.3.3 Discrete time systems as NHLRs 8.3.4 z transforms 8.3.5 Transfer function in z domain 8.3.6 Poles, zeros and stability
3	9. Proofs 9.1 Propositional logic 9.2 Logic operators 9.3 Methods of proof 9.3.1 Direct proof 9.3.2 Contrapositive proof 9.3.3 Proof by contradiction 9.3.4 Proof by induction 9.4 Boolean algebra in English
6	Tests and 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 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
Online assignments	20%
Tests (2) Test 1 (week 7): Wednesday 18 October 2023 Test 2 (week 12): Wednesday 22 November 2023	40%
Final exam (3 hours) 11-19 December 2023 To pass the course, students must obtain a minimum of 50% on the 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

Problem sets will be assigned (but not handed in) and solution sets will be posted. Short online assignments will be completed throughout the course. To be successful in the course, you must achieve 60% on theory and 60% on lab, including a minimum 50% on the final exam.

Optional references

1. N.L. Biggs, Discrete Mathematics, 2nd edition, Oxford.
2. Lemon Graph Tutorial <http://lemon.cs.elte.hu/pub/tutorial/>
3. Rardin, Optimization in Operations Research, 1998, Prentice Hall.
4. Hardy, Richman & Walkter, Applied Algebra – Code, Ciphers and Discrete Algorithms, 2nd edition, 2009, CRC Press.
5. Luenberger & Ye, Linear and Nonlinear Programming, 3rd edition, 2010, Springer.
6. Antoniou & Lu (ECE), Practical Optimization, 2007, Springer.
7. Skiena, The Algorithm Design Manual, 2nd edition, 2008, Springer.
8. Sedgewick, Algorithms in C, 3rd edition, 1997, Addison-Wesley.
9. Cormen et al, Introduction to Algorithms, 3rd edition, 2009, MIT.
10. Algorithms (UC-Berkeley) <http://www.cs.berkeley.edu/~vazirani/algorithms.html>
11. Discrete Mathematics (UCSD) <http://cseweb.ucsd.edu/~gill/BWLectSite/>
12. Foundations of Combinatorics (UCSD) <http://cseweb.ucsd.edu/~gill/FoundCombSite/>
13. Foundations of Computer Science (Stanford) <http://i.stanford.edu/~ullman/focs.html>

Algorithm Implementations

1. Algorithm Repository (C, C++, Java, etc) <http://www.cs.sunysb.edu/~algorithm/>
2. Essential Algorithms (Java) <http://algs4.cs.princeton.edu/home/>
3. Graph Library (C++) <http://lemon.cs.elte.hu/trac/lemon>
4. NEOS Solvers <http://www.neos-server.org/neos/solvers/>

Related UVic Engineering courses:

CSC 225, CSC 326, CSC 349, CSC 425, ELEC 403, ELEC 573, CENG 420, CENG 460

SCHOOL OR DEPARTMENTAL INFORMATION

Electronics & Computer Engineering Technology

Chair: James van Oort

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.