

# COURSE SYLLABUS



COURSE TITLE: ECET 282 Digital Signal Processing

CLASS SECTION: X01A, X01B

TERM: 2023W

COURSE CREDITS: 3

DELIVERY METHOD(S): in person

Camosun College campuses are located on the traditional territories of the Ləkʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.

Learn more about Camosun's [Territorial Acknowledgement](#).

## INSTRUCTOR DETAILS

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NAME: Joyce van de Vegte

NAME: David McMillan

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EMAIL: [mcmilland@camosun.ca](mailto:mcmilland@camosun.ca)

OFFICE: TEC 208

OFFICE: TEC 210

*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

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Students will be introduced to digital signal processing (DSP). They will study digital signals, filtering by difference equations and convolution, z transforms, frequency responses, spectra, the design of FIR and IIR filters, discrete Fourier transforms and fast Fourier transforms, DSP hardware and applications.

PREREQUISITE(S): C in ECET 260, C in ECET 281

## COURSE LEARNING OUTCOMES / OBJECTIVES

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

- describe the components of a general digital signal processing (DSP) system;
- draw and identify digital signals;
- filter a signal using a difference equation;
- filter a signal using convolution;
- analyze a filter using z transforms;
- determine the transfer function of a filter;
- find the frequency response of a filter;
- find the spectrum for a non-periodic signal;
- find the spectrum for a periodic signal;
- design a FIR filter;
- choose the order for an IIR filter;
- use a DFT to analyze the frequency content of a signal;
- identify the advantages of the FFT over the DFT;
- explain how DSPs differ from ordinary microprocessors;
- program a DSP for elementary applications.

## REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

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Website on D2L.

Optional text: van de Vegte, Fundamentals of Digital Signal Processing

## COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

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The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

HOURS	TOPIC	OTHER NOTES
1	Review from ECET 281 <ul style="list-style-type: none"><li>• Fourier Series</li><li>• Complex Fourier Spectra</li><li>• Fourier Transform</li><li>• Impulse Function and Impulse Response</li><li>• Convolution</li></ul>	
2	Introduction to Digital Signal Processing <ul style="list-style-type: none"><li>• A Simple DSP System</li><li>• Review of Sampling</li><li>• Review of Quantization</li><li>• Aliasing</li><li>• Oversampling and Undersampling</li></ul>	Ch. 2 2.1 - 2.7, 2.9, 2.11, 2.13, 2.15, 2.25
3	Digital Signals <ul style="list-style-type: none"><li>• Notation</li><li>• Basic Digital Signal Types</li></ul>	Ch. 3 3.1 - 3.6, 3.9, 3.10, 3.16 - 3.19, 3.23
4	Filtering <ul style="list-style-type: none"><li>• Analog vs Digital Filters</li><li>• Difference Equations</li><li>• Impulse and Step Responses</li><li>• Convolution</li><li>• Moving Average Filters</li></ul>	Ch. 4 4.9, 4.11, 4.13, 4.15, 4.16, 4.24, 4.25, 4.27, 4.28, 4.30, 4.32  Ch. 5 5.4, 5.5, 5.6, 5.13, 5.17, 5.18, 5.19  Problem set 1
5	z Transforms <ul style="list-style-type: none"><li>• Definition</li><li>• Transfer Functions</li><li>• Computing Filter Outputs</li><li>• Inverse z Transforms</li><li>• Poles and Zeros</li><li>• Stability</li></ul>	Ch 6 6.15abdef, 6.6 - 6.8, 6.17, 6.18, 6.23, 6.28, 6.30, 6.31, 6.34  Problem set 2

HOURS	TOPIC	OTHER NOTES
4	Frequency Responses and Spectra <ul style="list-style-type: none"> <li>• Fourier Transform</li> <li>• Filter Shape using Fourier Transform</li> <li>• Filter Shape using Poles and Zeros</li> </ul>	Ch. 7 7.7, 7.10, 7.17, 7.19, 7.24, 7.25  Problem set 2
5	FIR Filters <ul style="list-style-type: none"> <li>• Moving Average Filters</li> <li>• Characteristics of FIR Filters</li> <li>• Windowing</li> <li>• Design of Low, Band, and High Pass FIR Filters</li> <li>• Equiripple FIR Filters</li> </ul>	Ch. 9 9.1, 9.4, 9.6ab approx c, 9.12, 9.13, 9.15, 9.16, 9.20a, 9.21, 9.23, 9.26
4	IIR Filters <ul style="list-style-type: none"> <li>• Characteristics of IIR Filters</li> <li>• IIR Filters Derived from Analog Designs</li> <li>• Bilinear Transformation</li> <li>• Impulse Invariance IIR Design</li> </ul>	Ch. 10 10.3, 10.4abcd, 10.5, 10.6a, 10.7, 10.8, 10.15a, 10.21
4	Discrete and Fast Fourier Transform <ul style="list-style-type: none"> <li>• DFT</li> <li>• DFT Resolution</li> <li>• Spectrograms</li> <li>• FFT</li> </ul>	Ch. 11 11.2a, 11.4, 11.12, 11.13, 11.15, 11.16, 11.18, 11.21  Problem set 3
0.5	DSP Hardware <ul style="list-style-type: none"> <li>• DSP Architectures</li> <li>• Special Hardware Units</li> <li>• Special Instructions</li> </ul>	Ch. 12
0.5	Applications of DSP <ul style="list-style-type: none"> <li>• Signal Processing</li> <li>• Image Processing</li> </ul>	Ch. 14 Ch. 15
6	Test 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 advance 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>

Lab posting and due dates may be found on D2L.

WEEK	LAB NUMBER	LAB ACTIVITY
1	1	Applications of DSP
2	2	Spectra in MATLAB
3	3	Sampling and Quantization
4	4	Spectral Analysis in MATLAB
5	5	Defining Systems and Filtering in MATLAB
6		Reading Break
7	6	Introduction to Audio Weaver
8	7	Audio Effects
9	8	Voice Scrambling
10	9	Reverberation
11	10	DTMF Generation
12	11	DTMF Recovery
13	12	IIR Filters and FFTs

## EVALUATION OF LEARNING

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DESCRIPTION	WEIGHTING
Tests (2) Test 1 (week 5): Tuesday 7 February 2023 Test 2 (week 11): Tuesday 21 March 2023	35%
Labs	25%
Final exam: week of 17 – 25 April 2023 To pass the course, students must obtain a minimum of 50% on the final exam.	40%
<b>TOTAL</b>	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

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Problem sets will be assigned but not graded. Solution sets will be posted. To be successful in the course, you must achieve 60% on theory and 60% on lab, including a minimum 50% on the final exam.

## SCHOOL OR DEPARTMENTAL INFORMATION

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Electronics & Computer Engineering Technology  
Chair: James van Oort

## 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 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](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 250-3703841

### 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.