

COURSE SYLLABUS



COURSE TITLE: MENG 275 – Computational Modelling & Vibrations
CLASS SECTION: X01
TERM: 2023S
COURSE CREDITS: 3
DELIVERY METHOD(S): 3 Lecture hours and 2 Lab hours per week

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

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-faqs-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: Russ Rook
EMAIL: rook@camosun.ca
OFFICE: TEC 113
HOURS: T.B.A.

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 be introduced to computational modelling methods used to simulate and solve complex engineering problems. Simulations for parts and assemblies will include stress, vibration and thermal analysis using finite element analysis (FEA) methods, and fluid analysis using computational fluid dynamics (CFD) methods. The course will also introduce vibration analyses of linear systems and, free and forced excitation of single-degree-of-freedom systems. Practical applications and case studies will be emphasized using commercially available software.

PREREQUISITE(S):	C in all of MENG 253, MENG 273, MENG 283
CO-REQUISITE(S):	None
EXCLUSION(S):	Open to students in Mechanical Engineering Technology

COURSE LEARNING OUTCOMES / OBJECTIVES

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

- Describe the mathematical methods used by finite element analysis (FEA) and computational fluid dynamics (CFD).
- Select appropriate boundary conditions, fixtures, loads and other inputs when using FEA and CFD software.
- Analyze stresses, natural frequencies, thermal stresses and fluid flow in parts, basic assemblies and systems using FEA and CFD software.
- Interpret the output of computer-generated simulations and verify results with basic strength of materials and fluid dynamics theory.
- Describe the strengths and limitations of computation methods and explain why some simulations may produce incorrect results.
- Perform vibration analyses of single degree-of-freedom linear systems.
- Solve problems involving free and forced excitation of single degree-of-freedom systems.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

No textbook is required for this course.

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.

WEEK	ACTIVITY or TOPIC	EXAMS/PROJECTS	LAB EXERCISES
1	Introduction to computational methods & modelling.		Lab 1 – Intro to ANSYS
2	Finite element analysis (FEA), element types, discretization, stiffness matrices, shape functions and interpolation, boundary conditions, the governing equations of solid mechanics.		Lab 2 – Beam Analysis using ANSYS
3	Mathematical methods used in FEA, variational methods, Galerkin's method, the direct stiffness method, the FEM bar element.		Lab 3 – Contact Conditions in ANSYS
4	Postprocessing and stress recovery in FEA, interpretation of FEA output and verification of FEA results using strength of materials theory, strengths and limitations of FEA, FEA case studies.		Lab 4 – ANSYS Mesh Study
5	The finite difference method, Taylor expansion approximation, accuracy & stability.		Lab 5 – Fatigue Analysis in ANSYS
6	2D heat transfer analysis using the finite difference method, case studies, smoothed particle hydrodynamics (SPH).		Lab 6 – Heat Transfer Analysis in ANSYS
7	Computational fluid dynamics (CFD), the equations of fluid dynamics, boundary conditions in CFD.		Lab 7 – CFD Analysis using ANSYS

WEEK	ACTIVITY or TOPIC	EXAMS/PROJECTS	LAB EXERCISES
8	Mathematical methods used in CFD, the finite volume method (FVM), interpretation of CFD output and verification of CFD results using experimentation and fluid dynamics theory, strengths and limitations of CFD.		Project Work Period
9	Midterm Project presentations.	Midterm Project Presentations	-
10	Midterm Project presentations.	Midterm Project Presentations	-
11	Introduction to vibration, harmonic functions, free vibration, SDOF undamped systems, spring-mass system modelling, equivalent springs and viscous dampers.		Lab 8 – Intro to MATLAB
12	Methods for determining equations of motion, system response solutions.		Lab 9 – Solving ODE's Using MATLAB
13	Forced vibrations, resonance, damped vibrations, transient & steady-state response, the effect of damping on amplitude, rotational imbalance.		Lab 10 – Modal Vibration Analysis in ANSYS
14	Introduction to 2DOF systems, natural vibration modes, mode shapes.	Final Exam	Final Exam

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
Lab Exercises	30
Midterm Project Presentation	50
Final Exam	20
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

Lecture Attendance

To get the most out of this course, students are expected to attend all classes and be on time. It is your responsibility to acquire all information given during a class missed, including notes, hand-outs, changed exam dates etc.

Due Dates and Late Assignments

Lab sessions will consist of tutorials and in-class exercises, using AutoCAD, MS Excel, Solidworks and/or MATLAB software, when required. **No late lab exercises will be accepted for grading.** See

<http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for the Camosun grading policies.

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.

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.