

# COURSE SYLLABUS



COURSE TITLE: ENGR 291 – Solid Mechanics & Dynamics  
CLASS SECTION: DX01  
TERM: 2022W  
COURSE CREDITS: 3  
DELIVERY METHOD(S): 3.5 Lecture hours per week

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

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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.

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*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

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NAME: Russ Rook  
EMAIL: [rook@camosun.bc.ca](mailto:rook@camosun.bc.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

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In this course, the topics will cover differential equations applied to solid mechanics and dynamics. In addition to the detailed objectives, an overall objective of ENGR 291 is to integrate the concepts from different subjects to work effectively on multi-disciplinary engineering problems.

PREREQUISITE(S): C in MATH 250A; C in MATH 251  
CO-REQUISITE(S): C in MATH 250B; C in MATH 252; C in PHYS 295  
EXCLUSION(S): Open to students in Engineering Bridge

## COURSE LEARNING OUTCOMES / OBJECTIVES

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

- Describe 2-D motion of rigid bodies, and compute velocities and accelerations of any point on a rigid body.
- Determine the inertial (d'Alembert) forces and moments of a rigid body.
- Calculate applied forces and moments, to balance inertial forces and moments for a rigid body.
- Determine the kinematic and kinetic (motion, force and moment) values for a moving body from momentum and energy relationships (and vice-versa).
- Model and analyze the vibration of a one-dimensional system.
- Apply the fundamental concepts in Solid Mechanics:
  - equilibrium, compatibility and material behavior;
  - normal, shear and bearing stress;
  - stress concentration;
  - stress on an oblique plane; and
  - factor of safety.
- Describe multi-axial stresses and strains, Hooke's Law, Poisson's ratio, St. Venant's principle; volumetric strain, and bulk modulus. Analyze thin-walled pressure vessels.
- Transform stress and strain axes in two dimensions using Mohr's Circle and describe the concept of principle stresses.
- Analyze deformation, shear stress, elastic response, and angle of twist on circular shafts.
- Analyze indeterminate shafts.
- Determine the deformation, stress, and moment of inertia for beams in bending and apply the fundamental beam formula.
- Construct shear force and bending moment diagrams for transverse loading. Apply the elastic curve, direct integration method, singularity functions, superposition, and tabulated solutions.

## REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

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**No textbook required for ENGR 291; lecture notes are provided on D2L.**

## 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.

WEEK	ACTIVITY or TOPIC	QUIZZES	ASSIGNMENTS
1	<b>Dynamics</b> – Rigid body kinematics, relative positions and velocities.		
2	<b>Dynamics</b> – Relative accelerations of a rigid body.		
3	<b>Dynamics</b> – Rigid body kinetics, forces, moments, d'Alembert's principle.		Assignment #1
4	<b>Dynamics</b> – Rigid body kinetics using energy methods.		

WEEK	ACTIVITY or TOPIC	QUIZZES	ASSIGNMENTS
5	<b>Dynamics</b> – Vibration of single degree-of-freedom systems.		Assignment #2
6	<b>Dynamics</b> – Dynamics review.	Term 1 Exam	
7	READING BREAK – NO CLASSES OR LABS		
8	<b>Solid Mechanics</b> – Cartesian tensor notation, the stress tensor, normal and shearing stresses, the stress equilibrium equations.		
9	<b>Solid Mechanics</b> – Stress concentration factors, factors of safety, the strain tensor, compatibility equations, volumetric strain, Poisson’s ratio, constitutive equations and Hooke’s Law, St. Venant’s principle.		
10	<b>Solid Mechanics</b> – Stress and strain transformations, principle stresses as eigenvalues, 2D Mohr’s circle, thin-walled pressure vessels.		Assignment #3
11	<b>Solid Mechanics</b> – Bernoulli-Euler beam theory, second-moment of area and the flexure formula, load, shear, moment, slope, and deflection curves, singularity functions.		
12	<b>Solid Mechanics</b> – Beam analysis using direct integration and singularity functions.		Assignment #4
13	<b>Solid Mechanics</b> – Stress analysis and deformations of circular shafts, angle of twist, statically indeterminate shafts.		
14	<b>Solid Mechanics</b> – Solid Mechanics review.	Term 2 Exam	Assignment #5

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	20
Term 1 Exam	40
Term 2 Exam	40
<b>TOTAL</b>	<b>100%</b>

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

Assignments will be graded based on completion, with solutions posted to D2L on the ENGR 291 course page after the assignment is due. Assignments are due by 5:30 on the Friday of the weeks indicated in the above table, and **no late assignments 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

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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/>.

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.