
CIVE 421 – Advanced Structural Analysis**Term – Summer2020 (202005)**

We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.

Instructor name: Dr. Min Sun

Phone: 250-472-4468

E-mail: msun@uvic.ca

Office: ECS 312

Office Hours

Days: TBA

Time:

Location:

List all prerequisites and co-requisites: CIVE 350**Course Objectives**

This course is intended to develop a fundamental understanding on structural analysis using the stiffness method which forms the basis of the structural analysis software. Classical methods from CIVE 350 will be revisited as needed. The fundamental relationships of equilibrium and compatibility, as well as the contribution that subcomponents make to the overall stiffness of a structure will be expressed in the form of matrix equations. The stiffness method is applied to analyse statically indeterminate structures (truss, beam and frames) under different loading and self-straining conditions (misfit parts, temperature change, prestrain, etc.). Basic geometric and material nonlinearity will be introduced. Topics in this course represent the basis for the finite element method of analysis.

Learning Outcomes

After successfully completing this course, students will be able to

- (1) Apply their knowledge of engineering science (mechanics and material behaviour), mathematics (linear algebra), and computer science (Excel and Matlab) to perform linear and nonlinear structural analysis;
- (2) Apply classical methods for hand calculations of internal forces and deflections in simple structures;
- (3) Apply the stiffness method in matrix analysis of statically indeterminate structures (truss, beam and frames);
- (4) Solve self-straining problems (misfit parts, temperature change, prestrain, etc.);
- (5) Explain the theoretical basis of finite element method and commercial structural analysis software packages; and
- (6) Apply the knowledge acquired in this course and the design courses (CIVE 351 and CIVE 352) to determine the appropriate geometry of structural elements in accordance with building codes and design specifications.

Tentative Schedule

Module	Topics	Week
1	Force and Displacement Methods Quiz 1	1-3
2	Stiffness Method: 2D Truss	3-4
3	Stiffness Method: 2D Beam Quiz 2	5-6
4	Stiffness Method: 2D Frame	7-8
5	Self-Straining Problems Quiz 3	9-10
6	Application of Stiffness Method for 3D Truss and Frame Sources of Error	11
7	Geometric and Material Nonlinearity	11-13
8	Review Final Exam	13

A-Section(s): A01/CRN 30132

Days: Monday and Thursday

Time: 10:00 am - 11:20 am

Location: Blackboard Collaborate (link will be sent via email)

TA:

Sara Daneshvar

sara.daneshvarr@gmail.com

Required Text

Title: Structural Analysis, 10th Edition

Author: R. C. Hibbeler

Publisher/Year: Prentice Hall, 2017

Optional Text

Title: Matrix Structural Analysis, 2nd Edition

* An e-version (PDF) is available at no cost at

<http://digitalcommons.bucknell.edu/books/7>

Authors: W. McGuire, R. H. Gallagher & R. D. Ziemian

Publisher/Year: CreateSpace Independent Publishing Platform, 2015

Assessment

Assignments 20%

Quizzes 20%

Final Exam 60%

Due Dates: TBA

Date: TBA

Assignments: (Include Assignment Schedule) (Description & Method of Delivery)

Assignment #	Modules	Start	Due (5pm PDT)
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1. Weekly assignments must be done neatly in pencil, and preferably on the "engineering calculation paper". A straight edge and eraser are required for drawings.

2. The assignments must be submitted to CourseSpaces before the due time.

3. Each weekly assignment will contain several problems, and all must be attempted. Of all problems only one question (selected randomly) will be marked. However, if all assigned problems are not attempted a zero mark will be assigned to that particular problem set.

NOTE: (sample notes for all instructors)

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course

Failure to pass the final exam will result in a failing grade for the course.

Course Withdrawal Deadlines:

- May 16: Withdrawal with 100% reduction of tuition fees
- June 6: Withdrawal with 50% reduction of tuition fees
- July 1: Last day for withdrawal (no fees returned)

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

There will be no supplemental examination for this course.

Grading: Please see the Grading information in the current calendar at: <https://www.uvic.ca/calendar2020-05/undergrad/index.php/home#/policies>

Course policies and guidelines

Late Assignments: *No late assignments will be accepted unless prior arrangements have been made with the instructor at least 48 hours before the assignment due date.*

Coursework Mark Appeals: *All marks must be appealed within 7 days of the mark being posted.*

Attendance: We expect students attend all lectures and labs. It is entirely the students' responsibility to recover any information or announcements presented in lectures from which they were absent.

Electronic devices in labs and lectures: No unauthorized *audio* or *video* recording of lectures is permitted.

Electronic devices in midterms and exams: Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests *unless explicitly authorized*.

Plagiarism: Submitted work may be checked using plagiarism detection software. Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the link given below for the UVic policy on academic integrity. Note that the university policy includes the statement that "*A largely or fully plagiarized assignment should result in a grade of F for the course.*"

Academic Integrity: You must make yourself aware of the University of Victoria guidelines and policy concerning fraud and academic integrity at this link, <https://www.uvic.ca/current-students/home/academics/academic-integrity/index.php>

Policy on Academic Integrity: <https://www.uvic.ca/calendar2020-05/undergrad/index.php#/policies>

Standards of Professional Behaviour: You are advised to read the Faculty of Engineering Document Standards for Professional Behaviour in current Undergraduate Calendar, which contains important information regarding

conduct in courses, labs, and in the general use of facilities. Please find the document at this link:
<https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

Notes to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

University of Victoria Privacy Policy: If any student has concerns about their private information being stored or accessed outside of Canada, they are required to inform the course instructor about their concerns before the end of second week of classes.

Accommodation of Religious Observance: See entry in current Undergraduate Calendar.

Equality: This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Centre for Accessible Learning located in the Campus Services Building,
<https://www.uvic.ca/services/cal/>.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

Sexualized Violence Prevention and Response at UVic: UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting www.uvic.ca/svp. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out:

Where: Sexualized violence resource office in EQHR; Sedgewick C119

Phone: 250.721.8021

Email: svpcoordinator@uvic.ca

Web: www.uvic.ca/svp

Policy on Inclusivity and Diversity: See the entry in the current Undergraduate Calendar.

Course Lecture Notes

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Syllabus statement

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

Counselling Services - *Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students.*

<https://www.uvic.ca/services/counselling/>

Health Services - *University Health Services (UHS) provides a full service primary health clinic for students, and coordinates healthy student and campus initiatives.* <http://www.uvic.ca/services/health/>

Centre for Accessible Learning - *The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations* <https://www.uvic.ca/services/cal/>. *The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.*

Elders' Voices - *The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty and administration in Indigenous ways of knowing and being.*

<https://www.uvic.ca/services/indigenous/students/programming/elders/index.php>

The [Office of the Ombudsperson](#) is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations.

Phone: 250-721-8357; Email: ombuddy@uvic.ca; Web: uvicombudsperson.ca.