

**Western University - Faculty of Engineering**  
**Department of Civil and Environmental Engineering**

**CEE 3340a – Analysis of Indeterminate Structures - Course Outline 2024**

This course introduces methods of analysis for structures having a high degree of static indeterminacy such as continuous beams, trusses, plane frames, grids and multi-storey frames. The general objectives are for the student to become able to:

- identify, formulate, analyze and solve structural analysis and design problems involving statically indeterminate structures while working individually or functioning on a team.
- combine knowledge of statics, elastic deflection and compatibility gained in previous courses to understand and apply classical methods for the analysis of statically indeterminate trusses, beams and frames;
- improve communication skills by documenting design decisions in coherent and legible design calculations;
- develop an awareness of contemporary structures, and appreciate professional responsibility issues;
- recognize the need for life-long learning to keep abreast of new design and construction methods, enhance one's abilities as a designer, and maintain one's professional competence.

**Calendar Copy:**

A continuation of CEE 2221A/B. Methods of analysis of structures having a high degree of static indeterminacy such as frames, continuous beams and arches. Matrix formulation of the displacement methods and computer oriented analysis. Influence lines for indeterminate structures.

**Prerequisites:**

CEE 2221A/B

**Antirequisites:**

None

Note: It is the student's responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

**Contact Hours:**

**3 lecture hours/week;**

Lectures are organized into weekly learning modules, including both online lectures and in-person discussion. Students should review the online lectures in the week they are posted, and be prepared to discuss and apply the concepts presented during the weekly lecture sessions. Review of lecture material and attendance at lecture sessions should take approximately 6 hours per week.

**2 tutorial hours/week.**

A 2-hour tutorial session will be delivered each week during the scheduled tutorial hours. During tutorial sessions, students will work on weekly assignments and receive assistance from the course instructor and teaching assistants.

### **Contingency plan for an in-person class pivoting to 100% online learning.**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

### **Instructor:**

Dr. Jon Southen, SEB 3116

[jsouthen@uwo.ca](mailto:jsouthen@uwo.ca)

Office hours: by appointment

### **Textbook:**

*Structural Analysis*, A. Kassimali, CENGAGE Learning, 6th Edition, 2019, ISBN13: 978-1-337-63093-1 (Purchase of the text is recommended (hardcopy or ebook). (Previous editions may be acceptable.)

### **Other References:**

*Structural Analysis*, R. C. Hibbler, Pearson, 10<sup>th</sup> edition, 2017 (or previous editions).

### **Units:**

Both SI and FPS unit systems may be used in lectures, tutorials and examinations.

### **Specific Learning Objectives:**

The lectures and tutorial assignments will prepare students to do the following [GA Indicator]:

1. Calculate the displacements of determinate structures using methods learned in year 2 [KB 3]
2. Use the force method to analyze statically indeterminate beams, frames and trusses [KB 4]
3. Use the slope deflection method to analyze frame structures with both prismatic and non-prismatic members, including frames subjected to no joint translations, prescribed joint translations and unknown joint translations. The results of these analyses and subsequent analyses are deflections, bending moment and shear diagrams. [KB 4, PA 2]
4. Use the moment-distribution method to analyze frame structures with prismatic or non-prismatic members, including frames subjected to no joint translations, prescribed joint translations and unknown joint translations. [KB 4, PA 2]
5. Use the stiffness method to formulate the stiffness, force and displacement matrices required to analyze truss, beam and frame structures and apply the matrix stiffness approach to analyze indeterminate structures. [KB 4, PA 2]
6. Develop influence lines for statically indeterminate structures. [KB 4]
7. Understand and apply the Raleigh-Ritz method for approximate solutions of equilibrium problems. [KB 4]
8. Better understand the behaviour of structures, the influence of determinacy on structural response and the concepts of stiffness and flexibility of structures. [KB4]

The instructor may expand or revise material presented in the course as appropriate.

### **General Learning Objectives:**

E=Evaluate, T=Teach, I=Introduce; (Advanced level)

Knowledge Base	E (A)	Engineering Tools	T	Impact on Society	
Problem Analysis	T	Team Work		Ethics and Equity	
Investigation		Communication	T	Economics and Project Management	
Design		Professionalism		Life-Long Learning	

### **Accreditation Units:**

Engineering Science = 100%

### **Evaluation:**

The final mark will be determined as follows:

Weekly Assignments	30 %
Quizzes (2)	20 %
Participation	5 %
Final Examination	45 %
Total	100 %

**Note:** Students must pass the final examination to pass this course. Students who fail the final examination will be assigned the aggregate mark, as determined above, or 48%, whichever is less. Students who have failed this course previously must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted.

#### **1. Quizzes and Examinations:**

Two one-hour quizzes will be held during tutorial hours. These quizzes are *tentatively* scheduled for Wednesday, October 9 and Wednesday, November 13.

A three-hour written final examination will be held during the regular examination period.

#### **2. Weekly Assignments:**

Assignments will be given on a weekly basis. Assignments are to be submitted prior to the due date to OWL. In some circumstances, only a selection of questions from an assignment will be marked – the questions worth marks will not be determined or announced in advance. The intention is for students to complete the entire assignment in order to maximize learning the course material.

#### **3. Participation:**

Participation will be assessed based on class attendance, participation in lectures and tutorials and completion of short in-class assessments.

### **I. Missed/Late Accommodation Policy:**

1. Students missing a test/assignment/lab or examination you will report the absence by submitting Academic Consideration Request form through [STUDENT ABSENCE PORTAL](#).
2. Documentation must be provided as soon as possible.

## **II. Exam Accommodation:**

1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must submit an the Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

## **III. Late Assignments:**

1. Students must advise the course instructor if they are having difficulty completing an assignment on time (prior to the due date of the assignment).
2. Students should be prepared to submit the Academic Consideration Request Form and provide documentation if requested to do so by the course instructor (see reverse side for information on documentation).
3. If granted an extension, a revised due date should be established with the course instructor. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4. This course has 9 assignments with only 7/9 assignments counted towards your final grade. Academic consideration will not be granted for missed assignments. If students miss 2/9 assignments, the remaining 7 assignments will be used in the calculation of the final grade. If students miss more than 2 assignments, they will receive a grade of zero on each missed assignment.
5. This course employs flexible deadlines for assignments. The assignment deadlines will be clearly indicated in the assignment document. For each assignment, students are expected to submit the assignment by the deadline listed. Should illness or extenuating circumstances arise, students are permitted to submit their assignment up to 72 hours past the deadline without academic penalty. Should students submit their assessment beyond 72 hours past the deadline, a late penalty of 20% per day will be subtracted from the assessed grade. As flexible deadlines are used in this course, requests for academic consideration will not be granted. If you have a long-term academic consideration or an accommodation for disability that allows greater flexibility than provided here, please reach out to your instructor at least one week prior to the posted deadline.
6. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

#### **IV. Medical Accommodation:**

1. Requests for Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
2. Requests for academic consideration must include the following components:
  - a. Self-attestation signed by the student (*This is only accepted for the first/one absence*)
  - b. Medical note
  - c. Indication of the course(s) and assessment(s) affected by the request
  - d. Supporting documentation as relevant
3. Requests without supporting documentation are limited to one per term per course.
4. **Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.**
5. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline. Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Engineering.

#### **V. Religious Accommodation:**

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

#### **VI. Academic Integrity:**

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering](#) for more information

#### **VII. Academic Offences:**

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

## [Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know](#)

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

### **VIII. Faculty of Engineering AI Policy:**

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

### **IX. Use of English Policy:**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work except for the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

### **X. Accessibility:**

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

## **XI. Inclusivity, Diversity, and Respect:**

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

## **XII. Health and Well-Being:**

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - Western [is committed to reducing incidents of gender-based and sexual violence](#) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, [here](#). To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

### **Important Contacts:**

<a href="#">Engineering Undergraduate Services</a>	SEB 2097	519-661-2130	<a href="mailto:engugrad@uwo.ca">engugrad@uwo.ca</a>
<a href="#">Civil &amp; Environmental Engineering</a>	SEB 3005	519-661-2139	<a href="mailto:civil@uwo.ca">civil@uwo.ca</a>
<a href="#">Office of the Registrar/Student Central</a>	WSSB 1120	519-661-2100	

### **Important Links:**

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)