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 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. Tutorials are not mandatory but students seeking assistance with weekly assignments or clarification on lecture material are strongly encouraged to attend.
**Instructor:**
Dr. Jon Southen, SEB 3116  
jsouthen@uwo.ca
Office hours: by appointment

Administrative Assistant: Sandra McKay (smckay@uwo.ca)

**Textbook:**  
(Purchase of the text is recommended (hardcopy or ebook). Previous editions may be acceptable.)

**Other References:**  
*Structural Analysis*, R. C. Hibbler, Pearson, 10th 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:**

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>E=Evaluate, T=Teach, I=Introduce; (Advanced level)</th>
<th>Engineering Tools</th>
<th>T</th>
<th>Impact on Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>T</td>
<td>Team Work</td>
<td></td>
<td>Ethics and Equity</td>
</tr>
<tr>
<td>Investigation</td>
<td></td>
<td>Communication</td>
<td>T</td>
<td>Economics and Project Management</td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td>Professionalism</td>
<td></td>
<td>Life-Long Learning</td>
</tr>
</tbody>
</table>
Evaluation:
The final mark will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Quizzes (2)</td>
<td>20%</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

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 Tuesday, October 19 and Tuesday, November 16.

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. Late assignments will be assessed a penalty of 10% per day, to a maximum of 4 days, after which they will receive a mark of zero. Extensions are to be negotiated with the course instructor, not the teaching assistants.

3. Use of English:
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 with the exception of 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.

Cheating:
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.
For more information on scholastic offenses, please see:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Attendance:
Any student who, in the opinion of the instructor, has not engaged sufficiently in class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Accommodation:
Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive
testing. The accommodation policy can be found here: Academic Accommodation for Students with Disabilities.

**Academic Consideration for Student Absence**

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs and for the Student Medical Certificate (SMC), see:

**Religious Accommodation**

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.

**Use of Recordings:**

Any remote learning sessions for this course may be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor. The lecture notes and online lecture videos and tutorial sessions are copyrighted to the instructor and legally protected. Do not post these videos and lecture notes on any other website or online forums. The recording of the live/synchronous sessions of the course without the permission from the instructor is prohibited. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.
**Conduct:**
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam.
On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: [http://www.uwo.ca/univsec/board/code.pdf](http://www.uwo.ca/univsec/board/code.pdf)

**Contingency:**
In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining 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 at the discretion of the course instructor.

**Notice:**
Students are responsible for regularly checking their email, course website (https://owl.uwo.ca) and notices posted outside the Civil and Environmental Engineering Department Office.

**Consultation:**
Students are encouraged to discuss problems with their teaching assistant and/or the Instructor in tutorial sessions. Office hours will be arranged for the students to meet with the Instructor and teaching assistants. Other individual consultation can be arranged by appointment with the instructor.

**Course Breakdown:** (Values given in accreditation units)
Engineering Science = 100%

The attached document “INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS”