

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

**CEE 3340a – Analysis of Indeterminate Structures - Course Outline 2018**

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:**

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; 2 tutorial hours/week.

**Instructor:**

Dr. Jon Southen, SEB 3116

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

Administrative Assistant: SEB 3005

**Textbook:**

*Structural Analysis*, A. Kassimali, CENGAGE Learning, 5th Edition, 2015

(Purchase of the text is required. Previous editions may be acceptable.)

**Other References:**

*Structural Analysis*, R. C. Hibbler, Pearson, 9<sup>th</sup> edition, 2014.

**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:

1. Calculate the displacements of determinate structures using methods learned in year 2
2. Use the force method to analyze statically indeterminate beams, frames and trusses
3. Use the slope deflection method to analyze frame structures with prismatic members and no joint translations. The results of these analyses and subsequent analyses are deflections, bending moment and shear diagrams.
4. Use the slope deflection method to analyze frame structures with prismatic members and prescribed joint translations.
5. Use the slope deflection method in conjunction with the principle of virtual work to analyze frame structures with prismatic members and unknown joint translations.
6. Use the moment-distribution method to analyze frame structures with prismatic members and no joint translations
7. Use the moment-distribution method to analyze frame structures with prismatic members and prescribed joint translations.
8. Use the slope deflection and moment-distribution methods to analyze frame structures with non-prismatic members and prescribed joint translations.
9. Use the stiffness method to formulate the stiffness, force and displacement matrices required to analyze truss, beam and frame structures.
10. Apply the matrix stiffness approach in a computer oriented analysis.
11. Develop influence lines for statically indeterminate structures.
12. Understand and apply the Raleigh-Ritz method for approximate solutions of equilibrium problems

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

**General Learning Objectives:**

E=Evaluate, T=Teach, I=Introduce

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

**Evaluation:**

The final mark will be determined as follows:

Weekly Assignments	30 %
Quizzes (2)	20 %
Final Examination	<u>50 %</u>
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 Friday, October 19 and Friday, November 9.

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

Except for the use of a calculator, all quizzes and the final examination are closed book. Only approved programmable calculators are permitted in the final examination and quizzes. Students should consult the list of approved calculators posted outside the Civil and Environmental Engineering Department Office.

**2. Weekly Assignments:**

Assignments will be given on a weekly basis. Assignments are to be submitted prior to the due date and time in locker 56, second floor, Spencer Engineering Building. 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](http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf)

**Attendance:**

Any student who, in the opinion of the instructor, is absent too frequently from 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.

**Accessibility:**

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

**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. 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>

**Sickness and Other Problems:**

Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Students that are in emotional/mental distress should refer to Mental Health@Western

<http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help

For more information concerning medical accommodations, please see:

[http://www.uwo.ca/univsec/handbook/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf)

**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 see 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 OR SUBMIT ASSIGNMENTS AS SCHEDULED” is part of this course outline.

**INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED**

If, on medical or compassionate grounds you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

**A. GENERAL REGULATIONS & PROCEDURES**

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

**B. TERM TESTS**

1. If you are in first year and you are unable to write a term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling term tests.

**C. FINAL EXAMINATIONS**

1. If you are unable to write a final examination, contact the Undergraduate Services Office PRIOR TO THE SCHEDULED EXAMINATION TIME to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
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, 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 sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

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

#### **D. LATE ASSIGNMENTS**

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. 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. i) 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.  
ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

#### **E. SHORT ABSENCES**

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

#### **F. EXTENDED ABSENCES**

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You may want to seek advice from your academic counsellor in the Undergraduate Services Office.

#### **G. DOCUMENTATION**

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

***In Case of Serious Illness of a Family Member:*** Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

***In Case of a Death:*** Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

***For Other Extenuating Circumstances:*** If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

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

## H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your academic counsellor.

**Calendar References:** Check these regulations in your 2018 Western Academic Calendar available at [www.westerncalendar.uwo.ca](http://www.westerncalendar.uwo.ca).

Absences Due to Illness:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_12](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_12)

Academic Accommodations for Students with Disabilities:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_10](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_10)

Academic Accommodations for Religious or Holy Days:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_16](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_16) Course

Withdrawals:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page\\_75](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page_75)

Examinations:

<http://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=5&command=showCategory&SelectedCalendar=Live&ArchiveID=#>

Scheduling of Term Assignments:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading\\_78](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading_78)

Scholastic Offences:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_20](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_20)

Student Medical Certificate

: <https://www.eng.uwo.ca/files/undergraduate/forms/smc.pdf>

Engineering Academic Regulations:

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page\\_86](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page_86)

**Note:** These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

<b><u>Add Deadlines:</u></b>	First term half course (i.e. “A” or “F”)	September 14, 2018
	Full courses and full-year half course (i.e. “E”, “Y” or no suffix)	September 14, 2018
	Second term half course (i.e. “B” or “G”)	January 15, 2019

<b><u>Drop Deadlines:</u></b>	First term half course (i.e. “A” or “F”)	November 12, 2018
	Full courses and full-year half courses (i.e. “E”, “Y” or no suffix)	November 30, 2018
	Second term half or second term full course (i.e. “B” or “G”)	March 7, 2019

### **Contact Information:**

Undergraduate Services Office: SEB 2097 Telephone: (519) 661-2130 E-mail: [engugrad@uwo.ca](mailto:engugrad@uwo.ca)

Dept. of Chemical and Biochemical Engineering & Green Process Engineering: TEB 477 Telephone: (519) 661-2131 E-mail: [cbeugrad@uwo.ca](mailto:cbeugrad@uwo.ca)

Dept. of Civil and Environmental Engineering: SEB 3005 Telephone: (519) 661-2139 E-mail: [civil@uwo.ca](mailto:civil@uwo.ca)

Dept. of Electrical and Computer Engineering, Software Engineering & Mechatronics Engineering: TEB 279 Telephone: (519) 661-3758 Email: [eceugrad@uwo.ca](mailto:eceugrad@uwo.ca)

Dept. of Mechanical and Materials Engineering: SEB 3002 Telephone: (519) 661-4122 E-mail: [mmeundergraduate@uwo.ca](mailto:mmeundergraduate@uwo.ca)

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