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

**CEE2221b - Structural Theory and Design - Course Outline 2017/18**

**Introduction**
This course focuses on identification, formulation, analysis and design of civil engineering structures. After completing the course, the students will be able to

- identify the load path and tributary loading for surface loads on statically determinate three-dimensional structures;
- quickly calculate the reactions and draw the internal force diagrams for statically determinate two-dimensional structures based on equilibrium;
- quickly calculate the deflections of statically determinate two-dimensional structures using the moment-area method and virtual work principle;
- quantitatively determine the influence lines for statically determinate structures and use the influence lines to calculate the internal forces and deflections of structures subjected to moving loads;
- distinguish working stress and limit states designs, and recognize different types of loads in structural designs;
- use the limit states design approach to either proportion structural steel members subjected to axial force, shear force and bending moment or to check the adequacy of such members;
- apply the force method to analyze statically indeterminate structures with two degrees of redundancy, and
- work individually and in groups to develop the capacities for critical thinking, problem solving, as well as communicating their work and ideas both in writing and in oral class discussions.
- recognize the need for life-long learning to keep abreast of the new advancements in the analysis, design and construction of engineering structures, and to enhance one’s abilities as a civil engineer.

**Prerequisites:**
CEE 2202a/b, CEE 2220a/b and AM2270a/b

**Corequisites:**
None

**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, 2 tutorial hours per week

Attendance of the tutorial session is mandatory

**Instructor:**
Dr. Wenxing Zhou, P. Eng.
Textbook:
1. Structural Theory and Design – Lecture Notes, posted on OWL, required.

Other References:

Laboratory:
NA

Units:
Both SI and Imperial units will be used in lectures, tutorials and examinations

Specific Learning Objectives:
1. Introduction. At the end of this section, the students should be able to:
   a. recognize basic types of structure elements, structures and loads;
   b. distinguish working stress design and limit states design, and
   c. know the purposes of the Canadian national building code and various design codes.
2. Structural Idealization and Tributary Loading. At the end of this section, the students should be able to:
   a. know typical support conditions and joint connections, and convert supports and joints in actual structures into idealized support conditions and joint connections for performing structural analyses;
   b. create idealized framing plans for simple structures, and
   c. identify the load path and compute the tributary loading for vertically applied surface loads.
3. Analysis of Beams and Plane Frames. At the end of this section, the students should be able to:
   a. quickly quantify the axial force, shear force and bending moment diagrams for statically determinate beams and plane frames
   b. qualitatively sketch the deflection curves of beams and frames, and
   c. apply the principle of superposition to calculate the beam and frame internal forces.
4. Introduction to Strength Design. At the end of this section, the students should be able to:
   a. know the basic formats of the work stress design and limit states design, and
   b. use the limit states design formulae to check the adequacy of steel members subjected to tension, bending and shear.
5. **Deflection Calculation.** At the end of this section, the students should be able to:
   a. apply the Moment-area Method and Virtual Work Principle to calculate the deflections of statically determinate trusses, beams and two-dimensional frames, and
   b. qualitatively sketch the deflection curves for trusses, beams and frames.

6. **Influence Lines.** At the end of this section, the students should be able to:
   a. quickly quantify the influence lines for statically determinate trusses and beams using a tabulated solution and Muller-Breslau Principle, and
   b. apply the influence line to calculate the maximum internal forces in trusses and beams subjected to moving loads.

7. **Introduction to Indeterminate Structures.** At the end of this section, the students should be able to:
   a. identify the three general sets of conditions for structural analyses: equilibrium, constitutive model and compatibility condition, and
   b. use the force method to calculate the internal forces for statically indeterminate trusses, beams and frames with up to two degrees of redundancy.

### General Learning Objectives

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>Team Work</th>
<th>I</th>
<th>Economics and Project Management</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>E</td>
<td>Communication</td>
<td>I</td>
<td>Life-Long Learning</td>
</tr>
<tr>
<td>Investigation</td>
<td>-</td>
<td>Professionalism</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Design</td>
<td>I</td>
<td>Impact on Society</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Engineering Tools</td>
<td>-</td>
<td>Ethics and Equity</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Examinations and Quizzes:

1. Two one hour **Close Book** Quizzes will be scheduled during the first hour of the tutorial (i.e. from 12:30 to 1:30 pm) on February 12 and March 19, 2018, respectively.

2. One 3-hour **Close Book** Final Examination.

No programmable calculators or other external sources of information, including books, notes or crib sheets, are permitted in either the quizzes or final exam. A list of acceptable calculators for closed book exams will be posted on the bulletin board across from the Department of Civil and Environmental Engineering Office: please be sure your calculator is on it!

Should either of these dates conflict with a religious holiday that a student wishes to observe, the student must inform the instructor of the conflict no later than two weeks before the scheduled test. (For further information on Accommodations for Religious Holidays see [http://www.uwo.ca/univsec/handbook/appeals/religious.pdf](http://www.uwo.ca/univsec/handbook/appeals/religious.pdf)

### Assignments

Weekly assignments will be distributed in the tutorial periods. A tutorial group must submit one completed Part-A assignment by the end of each tutorial period. Group membership will be assigned by the course instructor, and may be revised during the term. All members of a group must be present and work on the assignments during the tutorials. All group members whose names are on a submission will receive the same mark. The **individual part of the weekly assignments, Part-B, are due on the following Monday**
by 10:30 a.m. in the designated locker (#53) on the 2ND FLOOR, SEB.  Assignments will be marked and returned during the following tutorial.  Late assignments will receive a grade of zero.

**Evaluation**
The final grade is computed as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorial Problems &amp; Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Final</td>
<td>50%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
</tr>
</tbody>
</table>

a). **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.

b). **Students must turn in all assignments and achieve a passing grade, to pass this course.** Students who do not satisfy this requirement will be assigned 48% or the aggregate mark whichever is less.

c). Students who have previously failed this course 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 for grading by the student in subsequent years.**

**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 the improper use of English. Additionally, poorly written work with the exception of final examinations 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.

**Plagiarism Checking:**
The University of Western Ontario uses software for plagiarism checking. Students are required to submit their Laboratory Reports in electronic form to Turnitin.com for plagiarism checking.

**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. 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

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.

For more information concerning medical accommodations, please see: 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 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 appropriate instructor.

Course Breakdown
Total = 50.8 AU’s
Engineering Science = 50% or 25.4 AU’s; Engineering Design = 50% or 25.4 AU’s

The 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. (SEE THE 2017 UWO ACADEMIC CALENDAR).

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 exam that is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097. Otherwise, you will report to your department office to request relief.

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 MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief. Otherwise, you will report to your department office 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.

N.B. 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 Associate Dean 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. 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.

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 the academic counsellor in your Department or Ms. Karen Murray in the Undergraduate Services Office, if you are in first year.

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 2017 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness: http://westerncalendar.uwo.ca/2017/pg117.html
Academic Accommodations for Students with Disabilities: http://westerncalendar.uwo.ca/2017/pg118.html
Academic Accommodations for Religious or Holy Days: http://westerncalendar.uwo.ca/2017/pg119.html
Course Withdrawals: http://westerncalendar.uwo.ca/2017/pg157.html
Examinations: http://westerncalendar.uwo.ca/2017/pg129.html
Scheduling of Term Assignments: http://westerncalendar.uwo.ca/2017/pg135.html
Scholastic Offences: http://www.westerncalendar.uwo.ca/2017/pg111.html
Student Medical Certificate: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf
Engineering Academic Regulations: http://www.westerncalendar.uwo.ca/2017/pg1442.html

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.

Drop Deadlines:
First term half course (i.e. “A” or “F”): November 5, 2017
Full courses and full-year half courses (i.e. “E”, “Y” or no suffix): November 30, 2017
Second term half or second term full course (i.e. “B” or “G”): March 7, 2017

Contact Information:
Undergraduate Services Office: SEB 2097 Telephone: (519) 661-2130 E-mail: engugrad@uwo.ca
Dept. of Chemical and Biochemical Engineering & Green Process Engineering: TEB 477 Telephone: (519) 661-2131 E-mail: cbeugrad@uwo.ca
Dept. of Civil and Environmental Engineering: SEB 3005 Telephone: (519) 661-2139 E-mail: civil@uwo.ca
Dept. of Electrical and Computer Engineering, Software Engineering & Mechatronics Engineering: TEB 279 Telephone: (519) 661-3758 E-mail: eceugrad@uwo.ca
Dept. of Mechanical and Materials Engineering: SEB 3002 Telephone: (519) 661-4122 E-mail: mmeundergraduate@uwo.ca

Revised 07/07/17