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

CEE2221b - Structural Theory and Design - Course Outline 2015/16

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:

ES 1022a/b/y, CEE 2202a/b, CEE 2220a/b or the former ES022a/b/y, CEE202a/b, CEE220a, ES202a/b and ES220a

Corequisites:

AM2411

Antirequisites:

The former ES221a/b or CEE221a/b

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. Aiham Adawi
E-mail: aadawi2@uwo.ca
Phone: ext. 88633
Office: CMLP1302
Office hour: Wednesday, (2-3) pm
Administrative support: Ms. Sandra McKay, SEB3005

Textbook:
1. *Structural Theory and Design* – Lecture Notes, posted on OWL, required.
2. *Structural Analysis*, A. Kassimali, CENGAGE Learning, 5th Edition, 2015, required – in UWO Bookstore.

Other References:
Mechanics of Materials, F.P. Beer and E.R. Johnston, Jr., 2nd Edition in SI Units, McGraw-Hill, 1992. Purchase optional
Structural Analysis, R. C. Hibbler, Prentice Hall, 8th Edition, 2012. optional.

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

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

Examinations and Quizzes:

1). Two one hour **Close Book** Quizzes will be scheduled from **9:00 to 10:00 am** on **February 11** and **March 24, 2016, respectively at the tutorial's location**.

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

Assignments

Weekly assignments will be distributed in the tutorial periods. At the beginning of the term, up to **two** students may form a tutorial group. A tutorial group must submit one completed Part-A assignment by the end of each tutorial period. 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, is due on the following Thursday by 10:30am. 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:

Tutorial Problems & Assignments	30%
Quizzes	20%
Final	50%
TOTAL	100%

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

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 SUBMINT ASSIGNMENTS AS SCHEDULED" is part of this course outline.