

CARLETON UNIVERSITY
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CIVE 4200 Matrix Analysis of Framed Structures

Fall 2020

Hours per week: Lecture 3
 Tutorial 1.5 hour / week

Course Description: Review of basic structural concepts. Matrix flexibility method, flexibility influence coefficients. Development of stiffness influence coefficients. Stiffness method of analysis: beams; plane trusses and frames; space trusses and frames. Introduction to the finite element method.

Learning Outcomes: Upon completion of this course, students will

- Be able to model and analyze indeterminate framed structures by the two basic approaches of flexibility (force) and stiffness (displacement) matrix structural analysis methods;
- Have the knowledge of the advantages and disadvantages between the flexibility and stiffness approaches;
- Have the knowledge of computer structural analysis;
- Be able to model and analyze indeterminate 2D and 3D framed structures by hand calculations and by computer structural modelling and analysis software.

Course Outline

1. Review of selected topics on basic structural analysis (CIVE 3203); Concept of force (flexibility) method and displacement (stiffness) method of structural analysis.
2. Flexibility method of analysis, flexibility influence coefficients, matrix flexibility equations.
3. Stiffness method of analysis, stiffness influence coefficients, fixed-end forces, matrix stiffness equations.
4. Maxwell-Betti's law; Influence lines and the Muller-Breslau principal.
5. Analysis of 3D structures: space trusses and space frames.
6. Second order structural analysis; Concept of geometric stiffness; Buckling of frame structures.

7. Fundamental of Finite Element Method; Concept of displacement shape functions for 1D axial bar element, and 2D beam element.
8. Introduction to Structural Dynamics; Free vibration of single-degree-of-freedom system; Modal analysis of multi-degree-of-freedom system; Natural frequencies and mode shapes.

Grades:	Assignments	25%
	Mid-term exam	25%
	(10 November 2020)	
	Final exam	50%

In addition to obtaining a minimum of 50% overall mark, it is required that a minimum of 40% out of 100 must be achieved in the final exam to pass the course.

Mid-term: 2 hr., ~~closed book, allow 2 single-sided or one double-sided page of notes (8.5" x 11")~~

Final exam: 3 hr., ~~closed book, allow 4 single-sided or two double-sided page of notes~~

Instructor: D.T. Lau 3436 ME

Office Hour: Tuesday 16:15-17:30 hr.
 Thursday 16:15-17:30 hr.
 or open office hour / see instructor to arrange alternative time

Teaching Assistant: Said Said
 Benjamin Clark
 (TA office hour will be announced at cuLearn website)

Reference text:

Hoit, M., Computer-Assisted Structural Analysis and Modeling, Prentice Hall, 1995.
 McGuire, W., Gallagher, R.H., Ziemian, R.D., Matrix Structural Analysis, John Wiley, 2000.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: students.carleton.ca/course-outline

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: students.carleton.ca/course-outline

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: students.carleton.ca/course-outline

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. students.carleton.ca/course-outline

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline