Civil and Environmental Engineering
CE 420/520 Computational Methods of Structural Analysis

Instructor:	Dr. Yongming Liu 234 Rowley Laboratories; Tel: 268-2341 E-mail: yliu@clarkson.edu Web: people.clarkson.edu/~yliu
Office Hours:	**TuTh 10:00 -11:00**; and anytime when I am in the office with the door open
Teaching Assistant:	TBA
Lecture/Lab:	**TuTh 8:00– 9:15 CB 178**
Web access:	Active Directory: S:\Classes\CEE\CE420-520

Catalog Description: The matrix stiffness method for the analysis of trusses, frames, plates, shells, and multi-component structures such as framework stiffened shells. Thermal stresses. Nonlinear effects.

Prerequisites: CE 320 and MA 339 or consent of the instructor

Textbook (recommended): *Matrix Analysis of Structures*, 2nd Edition, by Kassimali, Aslam, Brooks/Cole, 2012. ISBN-13: 9781111426200

Software: Matlab 2010 (or higher) student version (recommended)

Course Objectives:

1. To examine and comprehend the principles involved in structural analysis methods for the design of practical experiments.
2. To enable students to use fundamental principles of mechanics for the development and applications of structural analysis.
3. To introduce modern computational methods and software for the analysis of structures.
4. To prepare teams of students to apply the principles learned in the course to the analysis and design of structures.

Topics Covered:

Topic	Hours
Introduction of stiffness method for structural analysis	4 hours
Review of linear algebra	2 hours
Matrix analysis of plane trusses	8 hours
Matrix analysis of beams	6 hours
Matrix analysis of frames	4 hours
Advanced topics	2 hours
Computer programming of structural analysis	8 hours
Exams (exclusive of finals)	6 hours

Class Schedule:

Two 75-minute lectures per week

Contribution to Professional Component:

3 credits of Civil Engineering

Relationship of course to CEE program outcomes:

CEE Program Outcomes addressed:

1a) Students will have the ability to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry and principles of civil engineering including statics, strength of materials, materials science, fluid mechanics, soil mechanics, structural analysis, thermodynamics and engineering measurements.

1b) Students will have practical and hands-on laboratory experience solving several types of civil engineering problems involving measurement of physical phenomena and interpretation of the results.

1c) Students will have the opportunity to demonstrate their ability to design a system, component or process to meet desired needs through a capstone design project experience.

1d) Students will have the opportunity to demonstrate their ability to identify, formulate and solve engineering problems through a capstone design project experience.

1e) Students will have basic proficiency in at least four of the recognized civil engineering focus areas.

1f) Students will obtain basic computer skills consistent with applications to civil engineering problem solving.

1g) Students will have experience with individual and team-based approached to problem-solving in the classroom, laboratory, in an introduction to engineering design course and through a capstone design project experience, to be able to solve real-world open-ended problems that require creativity and risk-taking.

Examination policy:

The two in-class exams will be given in the CB 178 on Thursday February 9, Thursday March 8 at 7:30 am. The Final Exam will be scheduled during the final exam week. There will be no make-up exams. In unusual circumstances excuses may be granted for the in-class exams. For predictable absences, excuses must be requested well in advance

of the exam day. Excused exams will increase the weight of remaining exams and the Final Exam. There will be no excuse for the Final Exam. Exams will be closed book and closed notes. Only original handwritten cheat sheets of personal notes without example problems will be allowed during examinations. Exams will contain problems from completed computer projects as well as the other covered topics. The original problem papers, your solutions and cheat sheets will be stapled together and turned in.

Evaluation Methods:

1. Exam I (Feb. 9)	10	10%
1. Exam II (Mar. 8)	10	10%
1. Final Exam	30	30%
2. Project 1	10	10%
2. Project 2	10	10%
3. Homework	20	20%
4. Quiz	10	10%

100 total points
Letter grades will be assigned based on the following scale:

A	for	$G > 90$,
B+	for	$85 < G \leq 90$,
B	for	$80 < G \leq 85$,
C+	for	$75 < G \leq 80$,
C	for	$70 < G \leq 75$,
D+	for	$65 < G \leq 70$,
D	for	$60 < G \leq 65$,
F	for	$G \leq 60$.

The above represent minimum bounds. I reserve the right to adjust the grading scale to your benefit, based on your class performance.
Several short in-class quizzes will be given to check the attendance and your understanding of the lecture contents.
To encourage the students' participation in class, extra credits may be given to the student who gives correct answers to in-class questions. Each student may win maximum points of 5 for the entire semester.

CE 420 and CE 520:

Graduate students who take the CE 520 are required to finish all homework assignments and projects. In addition, they are required to solve one more problem in Exam I, Exam II and Final Exam, which will be marked as "CE 520 only".

CE 420/520 – Computer methods for Structural Analysis Topics List

Introduction

Flexibility method and stiffness method
Fundamentals of stiffness method
Matrix and linear algebra
Matrix structural analysis and finite element method

Matrix analysis of plane trusses
Global and local coordinate system
Degree of freedom and numbering structure
Member stiffness matrix
Coordinate transformation
Structural stiffness matrix
Member and support forces

Matrix analysis of beams
Global and local coordinate system
Degree of freedom and numbering structure
Member stiffness matrix
Member fixed-end forces due to load
Coordinate transformation
Structural stiffness matrix
Member and support forces

Matrix analysis of frames
Global and local coordinate system
Degree of freedom and numbering structure
Member stiffness matrix
Member fixed-end forces due to load
Coordinate transformation
Structural stiffness matrix
Member and support forces

Computer programming and commercial software
Input data structure
Global stiffness matrix assembling
Solution for joint displacement and member forces
Computer programming in Matlab
Practical application using STAAD-PRO

Advanced topics
Temperature changes and fabrication errors
Three dimensional space structures
Non-linear structural analysis

Persons(s) who prepared this description and date of preparation:

Y. Liu January 4, 2012