Pennsylvania State University
CE 340 Structural Analysis
Spring 2011
M W F 9:05 - 9:55AM, 158 WILLARD

Analysis of statically determinate and indeterminate trusses, beams and frames; Evaluation of support reactions, internal member forces (such as axial force, shear force and bending moment) and deflections; Introduction to influence lines.

Prerequisite: E MCH213. Prerequisite or concurrent: CMPSC201 or CMPSC202.

Instructor: Dr. Swagata Banerjee
221B Sackett Building
Phone: (814) 863 – 2936
Email: swagata@engr.psu.edu; sub28@psu.edu
Office hours: M 3:00 – 4:30 PM, W 10:15 – 11:45 AM,
And by appointments

Teaching Assistant: Zach Gabay; Email: zug102@psu.edu
321 Sackett Building
Office hours: T R 2:30 – 4:00 PM

Teaching Intern: Justin Long; Email: jpl5180@psu.edu
206-M Sackett Building; Office hours: M W 12 – 1:30 PM

Text: Structural Analysis by R.C. Hibbeler (7th Edition)

Additional Reference: Will be provided as required

Course Objectives: The course introduces different methods to analyze determinate and indeterminate structures. At the end of the semester students should be able to

- develop a clear knowledge of the basic types of structural systems,
- frame any given structural-analysis problem in a systematic manner (including the use of free body diagrams),
- accurately calculate reaction forces at supports and internal member forces (i.e., axial force, shear force and bending moment),
- effectively draw shear force and bending moment diagrams,
- evaluate deflection at any given location of the structure,
- identify an efficient method to analyze determinate and indeterminate structures and to analyze non-complex problems without using computer,
- verify results obtained from any computer-aided analysis.

Course Website: Course related materials (e.g., homework assignments and solutions) will be posted on ANGEL. Please check it regularly.

Exams: Midterm 1: Feb 16, 11 (W); During regular class hours
Midterm 2: Mar 30, 11 (W); During regular class hours
Final: Week of May 2 (Check e-lion account)

NO makeup exam will be arranged other than special circumstances. In case of any emergency, please inform me through e-mail. If no notification is made before the starting of the exam, there would NOT be any opportunity for makeup exams.

Homework: Homework should be submitted to me at the beginning of class on the due date mentioned on the homework. Your solutions should be neatly organized on engineering paper. Each problem should start on a separate page (use the **front of paper only**). **Late submission will be accepted until one week after the due date with 20% penalty.**

Reading Assignments: Reading assignments (selected textbook sections) will be given that are directly related to the material covered in class. You are expected to read these sections before coming to the next class.

Quizzes: In-class quizzes will be given at the beginning or end of the class. Best (n-1) out of n quiz grades will be considered for final grade. Quiz dates will be announced earlier.

Grades: **Best midterm** – 25%
Other midterm – 20%
Final – 25%
Homework – 20%
Quiz – 10%

Academic Integrity:
This course will follow the University Faculty Senate Policy 49-20 on academic integrity.

Definition and expectations: Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

To protect the rights and maintain the trust of honest students and support appropriate behavior, faculty and administrators should regularly communicate high standards of integrity and reinforce them by taking reasonable steps to anticipate and deter acts of dishonesty in all assignments (Senate Policy 44-40: Proctoring of Examinations). At the beginning of each course, it is the responsibility of the instructor to provide students with a statement clarifying the application of University and College academic integrity policies to that course. For more information, please go to http://www.psu.edu/ufs/policies/.

Course Outline:
As time permits, some additional materials will be presented in the class. The course topics as outlined below are subjected to minor changes during the semester.

Topics	Chapter	Reading sections
Introduction to structural analysis • Types of structural elements, structures, and loads • Structural design procedures	1	1.1-1.4
Basic concepts for structural analysis • Simplification for analysis o Supports or boundary conditions and connections o Idealization of structures o Loading and tributary area • Principle of Superposition • Free body diagrams and equilibrium equations • Computation of reactions using equations of equilibrium • Statically determinate and indeterminate structures • Stability	2	2.1-2.5
Analysis of Statically Determinate Trusses • Types of trusses • Sign convention and force representation • Method of joints • Zero-force members • Method of sections	3	3.1-3.5
Analysis of Statically Determinate Beams and Frames • Internal forces and sign convention • Load, shear and bending moment relationships • Axial, shear and moment diagrams for a beam • Axial, shear and moment diagrams for a frame • Use of superposition	4	4.1-4.5
Deflections • Principle of virtual work • Axial force-deformation relationships • Truss deflections by complementary virtual work • Beam and frame deflections by complementary virtual work	8 and 9	8.1-8.4 9.1-9.5

• Elastic beam theory and double integration method • Moment area method		
Analysis of Statically Indeterminate Structures by the Force Method • Advantages and disadvantages of statically indeterminate structures • Types of analysis • Force method of analysis • Analysis of beams • Analysis of frames • Analysis of trusses	10	10.1-10.6
Analysis of Statically Indeterminate Structures by the Slope Deflection Method • Displacement method of analysis • Slope deflection equation • Analysis of beams • Analysis of frames o No sidesway o Sidesway	11	11.1-11.5
Analysis of Statically Indeterminate Structures by the Moment Distribution Method • Definitions • Moment distribution for beams • Modified stiffnesses • Moment distribution for frames o No sidesway o Sidesway	12	12.1-12.5
Influence Lines • Description of influence lines • Constructing influence lines for beams • Qualitative influence lines (Müller-Breslau principle)	6, 10	6.1-6.3 10.10-10.11
Introduction to Matrix Methods (Stiffness Method)	14,15,16	