

COURSE OUTLINE

AE 308

Introduction to Structural Analysis

FALL 2007

1. COURSE OBJECTIVES:

At the conclusion of this course, students will be able to analyze statically determinate structures by exact methods and some types of statically indeterminate structures by approximate methods. Specific skills will include:

- a. Identification and calculation of gravity and environmental loads on a building structure.
- b. Identification of load paths in a building structure, and determination of loads on elements along the load path.
- c. Determination of reactions, internal forces and moments on elements of a statically determinate structure.
- d. Determination of internal forces in elements of a statically determinate truss.
- e. Determination of deflections of a statically determinate truss by the method of complementary virtual work.
- f. Determination of slopes and deflections of a statically determinate beam by the conjugate beam method.
- g. Calculation of approximate bending moments in sway frames by the portal and cantilever methods.
- h. Utilization of a frame analyses computer program to solve the structural analyses problems and compare to classic hand calculation methods.

The main objective of this course is to provide an overview of the structural design process and the place of structural analysis in that process.

2. EXPECTATIONS:

Class Participation: Active participation is a very important part of your learning process. Active participation includes attendance, attention, preparation (reading lecture material in advance), asking questions, answering questions and participation in in-class problem-solving and practicum sessions. A student who is prepared and continually and actively processes the class material will master the material (See Paragraph 42-27 of University Faculty Senate Policies for Students).

Homework: Working together on homework is encouraged. However, for your own sake, turn in homework that reflects your complete, *personal* understanding of the material. This standard is self-enforcing –your individual understanding will be reflected in the problems you work on the examinations. The instructors reserve the right to question your understanding of the submitted homework solutions and adjust the grades accordingly.

You will learn material by completing assigned reading and problem sets, in addition to material presented in lectures. Examples worked in class are not sufficient for mastery of the material. You must work additional problems on your own.

Examinations: Examinations will test your fundamental understanding of the material. This means that the examination problems will probably not resemble problems worked in class or in the homework.

3. INSTRUCTORS:

Sezer Atamturktur *Primary Course Instructor*
814-863-9093 Engineering Unit A, Room 202A
hsa109@psu.edu

Chris Caudill *Practicum Course Instructor (Section 1 & 2)*
Cpc154@psu.edu Engineering Unit B, Room 204 (office hours)

Kirk Stauffer *Practicum Course Instructor (Section 3)*
Kms491@psu.edu Engineering Unit A, Room 226 (office hours)

4. CLASS MEETING TIMES:

Lecture Sessions

All Sections MWF 11:15 AM-12:05 PM 160 Willard

Practicum Sessions

Section 1	T 1:25 PM -3:20 PM	124 Walker
Section 2	T 3:35 PM -5:30 PM	103 Walker
Section 3	R 1:25 PM -3:20 PM	014 Hend

5. COURSE ADMINISTRATION:

Administration: This course will be managed on ANGEL, and is accessible to enrolled students at <http://cms.psu.edu>. Please make use of this site, and consistently check it for updates.

Required Texts: Course Packet, available from Engineering Copy Center, approximate price \$33.00. Course packet consists of copyrighted material –most of the production cost is for copyright clearance.

Books on Reserve: Engineering Library, 4th floor Hammond Building.

TA645.H47 Hibbeler, R. C., (2006), Structural Analysis

TA645.S37 Schodek, D. L., (2004), Structures

TA645.W44 West, H. H., Geschwindner, L. F., (2002), Fundamentals of Structural Analysis

Prerequisites: EMch 11; EMch 13. Prerequisites will be strictly enforced.

6. OFFICE HOURS:

Section 1 & 2	Chris Caudill	TBD by section 1 and 2 students	2 hours/ week
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Section 3	Kirk Stauffer	TBD by section 3 students	2 hours/ week
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All Sections	Sezer Atamturktur	Thursdays 3:30p-5:30p	2 hours/ week
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When necessary, additional meetings can be arranged with the primary instructor via email.

7. CLASS MEETINGS:

Lecture Sessions:

Lecture sessions discuss the theory behind engineering problems. *Attendance is mandatory.* All major course announcements, including date changes, will be given in lecture sessions. Students are responsible for all information administered in lecture sessions.

Practicum Sessions:

Practicum sessions are primarily used to further analytical skills related to those taught in the primary section of the course. *Attendance is mandatory.* Practicum sessions may also be used for delivery of additional lecture material. Practicum sessions are equally important to lectures sections; students are equally responsible for information covered in these sessions.

8. EXAMINATIONS:

Quizzes: Since it is really difficult to learn and apply all the material in the few days prior to a midterm exam, your grade in this course will be more adequately assessed by shorter but more frequent quizzes administered on a weekly basis. Quizzes will generally be 15-25 minutes long, and be given as a part of Monday lectures (see lecture schedule). You are expected to be in class for every meeting, therefore *there will be no make-up quizzes.* To allow for occasional absences, the lowest quiz score will be dropped. The format of each quiz may vary. Unless otherwise specified, all quizzes are closed book / notes.

Final Exam: The final examination will be held as scheduled by the University. Do not make travel plans until after the final exam date and time have been announced (approx. the 6th week of class).

All quizzes and final examinations will be *comprehensive.* It is important that students are able to build and apply previous knowledge to each new task or challenge. The exam problems will be designed to assess your fundamental understanding of the course objectives.

9. HOMEWORK:

Homework will be assigned weekly on Fridays. Students will have one week to complete the homework. Homework will be collected only by the primary instructor at the beginning of the Friday lecture class. No late assignments will be accepted.

Homework must be done neatly, in pencil, on 8 1/2" x 11" engineering paper, stapled together. Each step must be easily followed; diagrams are useful. Homework that is not neat and legible may be rejected. Unclaimed work will be retained for 6 weeks after the start of the next semester and then discarded.

10. GRADE WEIGHTING:

Quizzes	50%
Homework	20%
Computer Project	5%
Final Examination	25%
Instructor's Bonus	5%

11. LETTER GRADE EQUIVALENTS:

93%-100%	A
83%-92%	B
73%-82%	C
65%-72%	D
0%-65%	F

Each student's lowest quiz score will be dropped.

This course's grades may be curved or adjusted to shift students' grades positively, but not negatively.

12. ACADEMIC INTEGRITY:

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.

13. HINTS FOR SUCCESS IN AE 308:

- a. Do not get behind. Studying regularly and devoting the necessary time to review the class material is the key for success. Although the time required to master the material may vary depending both on the student and topic, I recommend studying 9 -12 hours a week.
- b. Working numerous problems is the best way to learn structural analyses and design. Show your best effort in all homework problems and practicum sessions. However, your studies should not be limited to homework problems; you must solve additional problems on your own. Throughout the course, guidance will be given in identifying additional problems.
- c. There is no substitution for working together with friends. Teaching each other and asking questions are fundamental to learning. Make sure you have a study group for this class.
- d. Before and after a new topic is covered in class, read the material provided in the course packet. Reading in advance will help you to understand the lecture better, while the later reading will help you to refresh your memory and see the big picture.

Expected Outcome	Emphasis
(a) an ability to apply knowledge of mathematics, science, and engineering.	3
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.	
(c) an ability to design a system, component, or process to meet desired needs.	
(d) an ability to function on multi-disciplinary teams.	
(e) an ability to identify, formulate, and solve engineering problems.	2
(f) an understanding of professional and ethical responsibility.	
(g) an ability to communicate effectively.	
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context.	
(i) a recognition of the need for, and an ability to engage in life-long learning.	
(j) a knowledge of contemporary issues.	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	3

3=Strong; 2=Moderate; 3=Little; Blank=Nothing specific expected

Lecture Schedule

Week	Lecture	Date	Topic	Text	Notes / Assignments	
1	1	M	8/27/07	Syllabus and Course Overview		Classes Begin
	2	W	8/29/07	Load Paths		
	3	F	8/31/07	Calculation of Reactions		HW 1 Assigned
2		M	9/3/07	Labor Day Holiday		No Class
	4	W	9/5/07	Calculation of Reactions	Reading #1	
	5	F	9/7/07	Calculation of Reactions		HW 1 Due / HW 2 Assigned
3	6	M	9/10/07	Internal Forces in Trusses		Quiz 1
	7	W	9/12/07	Internal Forces in Trusses	Reading #2	
	8	F	9/14/07	Internal Forces in Trusses		HW 2 Due / HW 3 Assigned
4	9	M	9/17/07	Shear and Bending Moment		Quiz 2
	10	W	9/19/07	Shear and Bending Moment	Reading #3	
	11	F	9/21/07	Shear and Bending Moment		HW 3 Due / HW 4 Assigned
5	12	M	9/24/07	Gravity Loading, Dead Load		Quiz 3
	13	W	9/26/07	Gravity Loading, Live Load	Reading #4	
	14	F	9/28/07	Gravity Loading, Live Load Reduction		HW 4 Due / HW 5 Assigned
6	15	M	10/1/07	Lateral Loading, Wind Load		Quiz 4
	16	W	10/3/07	Lateral Loading, Wind Load	Reading #4	
	17	F	10/5/07	Lateral Loading, Wind Load		HW 5 Due / HW 6 Assigned
7	18	M	10/8/07	Conjugate Beam Method		Quiz 5
	19	W	10/10/07	Conjugate Beam Method	Reading #5	
	20	F	10/12/07	Conjugate Beam Method		HW 6 Due / HW 7 Assigned
8	21	M	10/15/07	Cantilevered Systems		Quiz 6
	22	W	10/17/07	Continuous Beams	Reading #5	
	23	F	10/19/07	Continuous Beams		HW 7 Due / HW 8 Assigned
9	24	M	10/22/07	Pattern Loading in Continuous Beams		Quiz 7
	25	W	10/24/07	Pattern Loading in Continuous Beams	Reading #5	
	26	F	10/26/07	Analysis of Three-Hinged Arch		HW 8 Due / HW 9 Assigned
10	27	M	10/29/07	Analysis of Portal Frame		Quiz 8
	28	W	10/31/07	Analysis of Portal Frame	Reading #5	
	29	F	11/2/07	Analysis of Portal Frame		HW 9 Due / HW 10 Assigned
11	30	M	11/5/07	Portal Method		Quiz 9
	31	W	11/7/07	Portal Method	Reading #6	
	32	F	11/9/07	Portal Method		HW 10 Due / HW 11 Assigned
12	33	M	11/12/07	Load Calculation: multi-story frame		Quiz 10
	34	W	11/14/07	Load Calculation: multi-story frame	Reading #6	
	35	F	11/16/07	Analysis of multi-story, multi-bay frames		HW 11 Due / CP Assigned
		M	11/19/07	Thanksgiving Holiday		No Class
		W	11/21/07	Thanksgiving Holiday		No Class
		F	11/23/07	Thanksgiving Holiday		No Class
13	36	M	11/26/07	Load Calculation: multi-story frame		Quiz 11
	37	W	11/28/07	Load Calculation: multi-story frame	Reading #6	
	38	F	11/30/07	Analysis of multi-story, multi-bay frames		
14	39	M	12/3/07	Analysis of multi-story, multi-bay frames		
	40	W	12/5/07	Analysis of multi-story, multi-bay frames	Reading #6	
	41	F	12/7/07	Analysis of multi-story, multi-bay frames		
15	42	M	12/10/07	Select Topics		
	43	W	12/12/07	Select Topics		
	44	F	12/14/07	Select Topics		Compter Project (CP) Due

This schedule is prone to change.

Practicum Schedule

Week	Section	Date	Topic	Notes / Assignments
1	1	T	8/28/07	No Practicum
	2	T	8/28/07	No Practicum
	3	R	8/30/07	No Practicum
2	1	T	9/4/07	Calculation of Reactions / Load Paths
	2	T	9/4/07	Calculation of Reactions / Load Paths
	3	R	9/6/07	Calculation of Reactions / Load Paths
3	1	T	9/11/07	Internal Forces in Trusses
	2	T	9/11/07	Internal Forces in Trusses
	3	R	9/13/07	Internal Forces in Trusses
4	1	T	9/18/07	Shear and Bending Moment
	2	T	9/18/07	Shear and Bending Moment
	3	R	9/20/07	Shear and Bending Moment
5	1	T	9/25/07	Gravity Loading
	2	T	9/25/07	Gravity Loading
	3	R	9/27/07	Gravity Loading
6	1	T	10/2/07	Lateral Loading
	2	T	10/2/07	Lateral Loading
	3	R	10/4/07	Lateral Loading
7	1	T	10/9/07	Conjugate Beam Method
	2	T	10/9/07	Conjugate Beam Method
	3	R	10/11/07	Conjugate Beam Method
8	1	T	10/16/07	Cantilevered Systems
	2	T	10/16/07	Continuous Beams
	3	R	10/18/07	Continuous Beams
9	1	T	10/23/07	Pattern Loading in Continuous Beams
	2	T	10/23/07	Pattern Loading in Continuous Beams
	3	R	10/25/07	Pattern Loading in Continuous Beams
10	1	T	10/30/07	Analysis of Portal Frame
	2	T	10/30/07	Analysis of Portal Frame
	3	R	11/1/07	Analysis of Portal Frame
11	1	T	11/6/07	Portal Method
	2	T	11/6/07	Portal Method
	3	R	11/8/07	Portal Method
12	1	T	11/13/07	Load Calculation: multi-story frame
	2	T	11/13/07	Load Calculation: multi-story frame
	3	R	11/15/07	Load Calculation: multi-story frame
	1	T	11/20/07	Thanksgiving Holiday
	2	T	11/20/07	Thanksgiving Holiday
	3	R	11/22/07	Thanksgiving Holiday
13	1	T	11/27/07	Load Calculation: multi-story frame
	2	T	11/27/07	Load Calculation: multi-story frame
	3	R	11/29/07	Analysis of multi-story, multi-bay frames
14	1	T	12/4/07	Analysis of multi-story, multi-bay frames
	2	T	12/4/07	Analysis of multi-story, multi-bay frames
	3	R	12/6/07	Analysis of multi-story, multi-bay frames
15	1	T	12/11/07	Exam Prep: Review Sessions
	2	T	12/11/07	Exam Prep: Review Sessions
	3	R	12/13/07	Exam Prep: Review Sessions

This schedule is prone to change.