

COURSE OUTLINE
AE 308
Introduction to Structural Analysis
FALL 2009

A web page will be maintained for this course on the ANGEL system. The use of ANGEL will be limited to posting of homework and solutions, quiz and examination solutions, and class handouts as required. Please direct all communication with me to my e-mail address or phone number below. Material posted on ANGEL is accessible at <http://cms.psu.edu>

Prerequisites

EMch 211; EMch 213; *Prerequisites will be enforced.*

Class Meets:

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

Section 1; T 1:25-3:20, 124 Walker
Section 2; T 3:35-5:30, 103 Walker
Section 3; R 1:25-3:30, 14 Henderson

Instructor:

Thomas E. Boothby, Ph.D, P.E., R.A.
209 Engineering Unit A
863-2082
tebarc@engr.psu.edu.

Please note that I check e-mail at most once daily. Please use the above address, rather than the e-mail utility in ANGEL. Urgent matters can be addressed by telephone.

Office Hours:

W 1:00-2:30 PM
F 2:30-4:00 PM
other times by appointment

Graduate Teaching Assistant:

Hooman Tavallali
hzt105@psu.edu
203 Engineering Unit A

Undergraduate Teaching Intern:

Kade Gromowski
klg5081@psu.edu

Required Texts:

Leet, Uang, and Gilbert, *Fundamentals of Structural Analysis*, McGraw-Hill, Third Edition, 2008. For those of you continuing in structures, this will also be used in AE 430 in fourth year.

These books are on 2-hour reserve in the Engineering Library.

Hibbeler, R.C. *Structural Analysis*, Fifth Edition, 2006, Prentice-Hall

West, H.W., and Geschwindner, L.F, *Fundamentals of Structural Analysis*, Second Edition, 2002, John Wiley and Sons, ISBN 0-471-35556-9.

International Code Council, *International Building Code 2006*.

Practicum Sessions:

Practicum sessions meet Tuesday 1:25-3:20 (Section 1), Tuesday 3:35-5:30 (Section 2), and Thursday 1:25-3:20 (Section 3). The sessions are primarily used for problem-solving related to upcoming homework assignments or exams. Practicums may also be used for delivery of additional lecture material. Some practicums will be scheduled in the AE Department Computer Labs, or off-campus. These sessions are noted on your practicum schedule or will be announced in advance. Please expect to spend the entire scheduled practicum session in course-related work.

Examinations and Quizzes

Two evening examinations are scheduled.

Thursday October 1, 8:15-10:15 PM, 26 Hosler
Thursday October 29, 8:15-10:15 PM, 26 Hosler

I must be notified of any conflicts *immediately*, by the end of the second week of class at the latest.

A third evening exam will be used as the only form of conflict or make up examination in this class. Any student who, for whatever reason, has missed one of the previous two examinations, may take this exam.

Thursday November 19, 8:15-10:15PM, 26 Hosler

A student who has had a poor result on one of the first two exams may also take this exam, *with my permission in advance only*.

The final examination will be held as scheduled by the University. Do not make travel plans for finals week until after the final exam date and times have been announced (approximately the sixth week of classes)

All examinations will be *open book* and *open notes*. No sharing of notes, books, or calculators will be permitted. No cell phones will be permitted in the examination room. Please bring a watch or some other means of keeping time, if necessary.

Homework

Homework will be assigned weekly. Homework will generally be due on Monday at the start of class, except that Homework 1 will be due on Friday 28 August. Homework may be turned in prior to the deadline during a lecture or practicum session, or placed in my mailbox in 104 Engineering Unit A. Homework must be done neatly *in pencil* on 8 1/2" × 11" paper, stapled together. Homework not complying with these requirements may be rejected. Late homework will not be accepted for credit.

Course Objectives

At the conclusion of this course students will have an overview of the structural design process and the place of structural analysis in that process. 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

Identification and calculation of gravity and environmental loads on a building structure.

Identification of load paths in a building structure, and determination of loads on elements along the load path.

Determination of reactions, internal forces and moments on elements of a statically determinate structure.

Determination of internal forces in elements of a statically determinate truss.

Determination of slope and deflection of beams by the conjugate beam method

Solution of statically indeterminate beams by the conjugate beam method.

Application of computer analysis programs to the determination of shear and bending moments in continuous beams under varying load conditions

Application of computer analysis programs to the determination of shear and bending moment in portal frames, and multi-story, multi-bay frames.

The ability to check computer results by exact or approximate methods of structural analysis.

Calculation of approximate bending moments in sway frames by the portal method.

Expectations

I expect active participation from all members of the class. Active participation includes the following components

- Attendance
- Attention
- Preparation, that is, reading textbook and lecture material in advance
- Asking questions
- Answering questions
- Participation in in-class problem-solving and practicum sessions.

Active participation is a very important part of your learning process. A student who is prepared and continually and actively processes the class material will master the material.

Average of 8 hours/week work outside of class. I will adjust assignments and due dates to avoid major project deadlines in other classes.

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*. Guidance will be given in identifying additional problems.

Although I cannot prevent, and actually encourage, working together on homework, any paper submitted with your name on it should reflect your *complete, personal* understanding of the material. (Note: this standard is self-enforcing—your individual understanding will be reflected in the problems you work on the examinations.)

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

Class Policies

University H1N1 Flu Policy: If you are sick with any flu-like symptoms, you are asked to comply with the University policy (http://senate.psu.edu/special_announcements/H1N1.pdf). In particular, do not come to class and avoid all unnecessary contact with people. Because the time frame for recovery is approximately one week, I am allowing everyone to miss one homework without affecting their final grade. If you are ill during an examination, plan to take the conflict/make up examination on November 19.

No make-up exams, other than the general make-up and conflict examination offered the evening of 19 November.

Attendance and participation in the class are expected. (See Paragraph 42-27 of University Faculty Senate Policies for Students). See comments regarding class participation under 'Expectations' above.

Assignments will be submitted at the assigned time. Late work will receive no credit. I am sympathetic to altering homework deadlines to reduce conflicts with other courses, *if you notify me in advance so I can adjust the due date*. Unclaimed work will be retained for 6 weeks after the start of the next semester and then discarded.

Academic Integrity

Academic Integrity policy will be enforced per University Faculty Senate Policies for Students 49-20 (available at <http://www.psu.edu/ufs/policies/>), and applicable policies of the College of Engineering (available at <http://www.engr.psu.edu/Forms/AcademicIntegrity/AcademicIntegrityProceduresMarch2008.pdf>)

Examinations will not be formally proctored, but will be conducted under an honor system, in accordance with Section 44-40 of University Faculty Senate Policies for Students

- Nominations for honor council will be taken during the first week of class.
- An honor council of 3 students and one alternate will be elected in the second week of class.
- Each student will sign a statement asserting that each examination represents their own work alone, and that the rules have been complied with.
- Sharing of work, notes, books, calculators, or use of cell phones during examinations will be considered violations of academic integrity.
- Failure to report a violation will be considered a violation of academic integrity policy.
- Students will report any violations to a member of the honor council. The honor council will determine responsibility, recommend sanctions, and refer the issue to me for consultation and processing.

Grade Weighting:

Homework	20%
Examinations (25% each)	50%
Final Examination	30%

Letter Grade Equivalents:

91%-100%	A
81%-90%	B
71%-80%	C
61%-70%	D
0%-60%	F

AE 308; Fall 2008; Course Outcomes

Expected Outcome	Emphasis in this course
(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; 1=Little; Blank=Nothing specific expected

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Fall 2009
Lecture Schedule

Week	Lecture	Date	Topic	Text
1	1	8-24	Introduction to Structural Design Process	
	2	8-26	Load Paths	2.3 (29-36) + handout
	3	8-28	Load Paths and calculation of reactions	
2	4	8-31	<i>Review Material:</i> Calculation of Reactions	Chapter 3 (73-120)
	5	9-2	<i>Review material:</i> Calculation of Reactions	
	6	9-4	<i>Review material:</i> Internal forces in trusses method of joints	Chapter 4 (123-164)
3		9-7	No Class: Labor Day	
	7	9-9	<i>Review material:</i> Internal forces in trusses method of sections	
	8	9-11	Internal forces in trusses computer analysis	
4	9	9-14	<i>Review material:</i> Shear and bending moment	Chapter 5 esp.5.1- 5.5, (167-223)
	10	9-16	<i>Review material:</i> Shear and bending moment	
	11	9-18	<i>Review material:</i> Shear and bending moment	
5	12	9-21	Gravity Loading; Dead Load	2.3 (28-36)
	13	9-23	Gravity Loading; Live Load	2.4 (36-41) + IBC excerpt
	14	9-25	Gravity Loading, Live Load Reduction	
6	14	9-28	Lateral Loading; Wind Load	2.5 +IBC Excerpt (43-59)
	15	9-30	Lateral Loading: Wind Load	
Examination #1 Thursday October 1; 8:15-10:15 PM; 158/160 Willard				
	16	10-2	Lateral Loading: Wind Load	
7	17	10-5	Beam slope and deflection by conjugate beam method	9.1-9.2 (310-317) 9.5 (340-361)
	18	10-7	Beam slope and deflection by conjugate beam method	
	19	10-9	Conjugate beam method	
8	20	10-12	Conjugate beam method	
	21	10-14	Analysis of beams by conjugate beam	
	22	10-16	Analysis of continuous beams	
9	23	10-19	Analysis of continuous beams	
	24	10-21	Pattern loading in continuous beams	notes on computer application
	25	10-23	Pattern loading in continuous beams	

Week	Lecture	Date	Topic	Text
10	26	10-26	Approximate analysis of continuous beams	
	27	10-28	Analysis of three-hinged arch	
Examination #2 Thursday October 30; 8:15-10:15; 26 Hosler				
	28	10-30	Analysis of portal frame	
11	29	11-2	Analysis of portal frame	
	30	11-4	Analysis of portal frame	
	31	11-6	Portal method and cantilever method	15.9 (638-651)
12	32	11-9	Portal method	
	33	11-11	Load calculation: multi-story frame	
	34	11-13	Load calculation: multi-story frame	
13	35	11-16	Analysis of multi-story, multi-bay frames	
	36	11-18	Analysis of multi-story, multi-bay frames	
Conflict/Make-up Examination; Thursday November 20; 8:15-10:15; 26 Hosler				
	37	11-20	Review and make-up	
Thanksgiving Break				
14	38	11-30	Moment Distribution Method	13 (514-542)
	39	12-2	Moment Distribution Method	
	40	12-4	Moment Distribution Method	
15	41	12-7	Moment Distribution Method	16 (660-681) + handout
	42	12-9	Moment Distribution Method	
	43	12-11	Moment Distribution Method	

AE 308
Fall 2009
Practicum Schedule

Practicum sessions are focused on problem-solving, and the skills necessary to complete current homework sets or upcoming examinations. The full scheduled session will be used.

*Please note that mandatory supplemental information will be presented in practicum during Week*7 (10-5 through 10-9).*

Week	Section	Date	Topic	Assignment
1	1/2	8-25	Initial review of structures concepts	HW 1 (8-28) <i>Diagnostic</i>
	3	8-27		
2	1/2	9-1	Reaction calculations	HW 2 (9-7) <i>Reactions</i>
	3	9-3	Reaction calculations	HW 2
3	1/2	9-8	Truss Analysis (307 Sackett)	HW 3 (9-14) <i>Trusses</i>
	3	9-10	Truss Analysis (307 Sackett)	HW 3
4	1/2	9-15	Shear and Bending Moment	HW 4 (9-21) <i>Shear and Bending Moment</i>
	3	9-17	Shear and Bending Moment	HW 4
5	1/2	9-22	AE CAREER FAIR No Practicum	HW 5 (9-28) <i>statics summary</i>
	3	9-24		HW 5
6	1/2	9-29	Examination Preparation	
	3	10-1	Examination Preparation	
Examination 1; Thursday 1 October; 8:15-10:15 PM; 158/160 Willard				
7	1/2	10-6	Lateral Loads	<i>Earthquake Loads</i> HW 6 (10-12) <i>Loads</i>
	3	10-8	Lateral Loads	<i>Earthquake Loads</i> HW 6
8	1/2	10-13		HW 7 (10-19) <i>Conjugate Beam</i>
	3	10-15		HW 7
9	1/2	10-20	computer analysis of beams (307 Sackett)	HW 8 (10-26) <i>Continuous Beams</i>
	3	10-22	computer analysis of beams (307 Sackett)	HW 8
10	1/2	10-27	Exam 2 preparation	
	3	10-29	Exam 2 preparation	
Examination 2; Thursday 29 October; 8:15-10:15 PM; 26 Hosler				

Week	Section	Date	Topic	Assignment
11	1/2	11-3	analysis of frames (307 Sackett)	HW 9 (11-9) <i>Portal Frames</i>
	3	11-5	analysis of frames (307 Sackett)	HW 9
12	1/2	11-10	Load Calculation: multi-story frame	HW 10 (12-4) <i>Frame analysis project</i>
	3	11-12	Load Calculation: multi-story frame	
13	1/2	11-17	multi-story frame (307 Sackett)	HW 10
	3	11-19	multi-story frame (307 Sackett)	HW 10
Conflict/Make-up Exam: Thursday 20 November; 8:15-10:15 PM; 26 Hosler				
14	1/2	12-1	multi-story frame (307 Sackett)	HW 10
	3	12-3	multi-story frame (307 Sackett)	HW 10
15	1/2	12-8	review	
	3	12-10	review	