FALL SEMESTER 2010

THE PENNSYLVANIA STATE UNIVERSITY
Department of Architectural Engineering

Syllabus

AE 430 - INDETERMINATE STRUCTURES

Instructor: Dr. Richard A. Behr, P.E.

(Mon. & Wed. 11:15 a.m. – 12:30 p.m. 302 Unit B)

Office Hours for Dr. Behr: M,W 2:30 – 4:30 p.m. 216 Eng. Unit A
863-8903 (office phone) behr@engr.psu.edu

Teaching Assistant: TBD

Catalog Description
Classical methods of analysis for beams, arches, and secondary stresses as applied to buildings; introduction to modern methods.

Course Learning Objectives
The following learning objectives will be achieved by each student completing the course:

1. To become proficient at implementing various classical structural analysis methods applied to statically indeterminate structures with low degrees of indeterminacy.

2. To develop heuristics for preferred classical solution methods for various types of statically indeterminate structures.

3. To develop an improved understanding of the behavior of various structural systems in response to various external loads.

4. To become proficient at using a professional structural analysis software package to model and analyze indeterminate structural systems; to interpret and validate judiciously the resulting computer structural analysis output.

Expected Outcome (for ABET accreditation evaluations)	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	0
(c) an ability to design a system, component, or process to meet desired needs	2
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	3
(f) an understanding of professional and ethical responsibility	1
(g) an ability to communicate effectively	1
(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 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

Emphasis: 3 – Strong; 2 – Moderate; 1 – Little; Blank – Nothing specific expected

Academic Integrity Policy
See Academic Integrity Link

Disability Access Statement
See Office for Disability Services web pages

Grading Policy

	Course Grade Component (%)
Homework Assignments	20
Exams (2)	27 x 2 = 54
Final Exam	26

Grade	Total Grade Percentage
A	95-100
A-	90-95
B+	85-90
B	80-85
B-	75-80
C+	70-75
C	65-70
D	60-65

Text Requirements

Fundamentals of Structural Analysis (Third Edition) by K. M. Leet, C-M Uang, and A. M. Gilbert; McGraw-Hill, 2008.

AE 430 – Indeterminate Structures Lecture Notes (Fall 2010 Edition) by R. A. Behr; available for purchase at the Engineering Copy Center in Engineering Unit A.

Special Fall 2009 Flu Protocols (from PSU Provost Rodney Erickson, 8/6/09)

"In compliance with Pennsylvania Department of Health and Centers for Disease Control recommendations, students should NOT attend class or any public gatherings while ill with influenza. Students with flu symptoms will be asked to leave campus if possible and to return home during recovery. The illness and self-isolation period will usually be about a week. It is very important that individuals avoid spreading the flu to others.

Most students should be able to complete a successful semester despite a flu-induced absence. Faculty will provide students who are absent because of illness with a reasonable opportunity to make up missed work. Ordinarily, it is inappropriate to substitute for the missed assignment the weighting of a semester's work that does not include the missed assignment or exam. Completion of all assignments and exams assures the greatest chance for students to develop heightened understanding and content mastery that is unavailable through the weighting process. The opportunity to complete all assignments and exams supports the university's desire to enable students to make responsible situational decisions, including the decision to avoid spreading a contagious virus to other students, staff, and faculty, without endangering their academic work.

Students with the flu do not need to provide a physician's certification of illness. However, ill students should inform their teachers (but not through personal contact in which there is a risk of exposing others to the virus) as soon as possible that they are absent because of the flu. Likewise students should contact their instructors as quickly as possible to arrange to make up missed assignments or exams."

If you have questions about academic policy-related issues, please call the Associate Dean/Chief Academic Officer of your college. For health-related questions you can email Dr. Margaret Spear, director, University Health Services, at uhsinfo@sa.psu.edu.

COURSE OUTLINE

W	L	DAY/DATE		TOPIC	ASSIGNMENT
1	1	M	8/23	Course introduction; syllabus review; introduce computer structural modeling.	
	2	W	8/25	Computer structural modeling with STAAD Preliminary structural design of the St. Louis Gateway Arch using STAAD	Leet et al. P9.41 using STAAD (Due 8/30)
2	3	M	8/30	Wind loads (ASCE 7 Method 2)	Wind load assignment (Due 9/8)
	4	W	9/1	Wind loads	
3		M	9/6	Labor Day – no class	
	5	W	9/8	Seismic loads (ASCE 7)	Seismic load assignment (Due 9/15)
4	6	M	9/13	Seismic loads	
	7	W	9/15	Distribution of shear forces at a given story level.	Story shear forces assignment (Due 9/22)
5	8	M	9/20	Distribution of shear forces	Read Leet et al. Chapter 6
	9	W	9/22	Cables	HW: 6.5; 6.10; 6.14* (Due 9/27)
6	10	M	9/27	Cables	Read Chapter 7 HW: 7.3; 7.5; 7.12* (Due 10/11)
	11	W	9/29	4th Year Chicago Trip – no class	
7	12	M	10/4	Arches	
	13	W	10/6	Exam 1	
8	14	M	10/11	Influence Lines (I.L.)	Read Chapter 8 and 14.4 – 14.5; HW: 8.3; 8.4; 8.7; 8.15; 8.26* (Due 10/18)
	15	W	10/13	I.L.	Read Chapter 10
9	16	M	10/18	Work-Energy Methods for Deflections	HW: 10.3; 10.8; 10.11; 10.13; 10.29; 10.31 (Due 10/27)
	17	W	10/20	Virtual Work (Trusses; Frames)	
10	18	M	10/25	Bernoulli's Principle; Maxwell-Betti Law	Read Chapter 11
	19	W	10/27	Flexibility Method (F.M.), a.k.a. Force Method or Method of Consistent Deformations	HW: 11.2; 11.7; 11.11; 11.24*; 11.37; 11.45 (Due 11/8)
11	20	M	11/1	F.M.	
	21	W	11/3	F.M.	Read Chapter 12
12	22	M	11/8	Slope-Deflection Method (S-D)	HW: 12.5; 12.8; 12.9; 12.14; 12.25* (Due 11/15)
	23	W	11/10	S-D	
13	24	M	11/15	S-D	Read Chapter 13 (Omit 13.8 -13.9)
	25	W	11/17	Exam 2	
14				Thanksgiving – no classes 11/22 – 11/26	
15	26	M	11/29	Moment Distribution Method (M.D.)	HW: 13.7; 13.11; 13.19; 13.23; 13.26* (Due 12/6)
	27	W	12/1	M.D.	
16	28	M	12/6	M.D.	
	29	W	12/8	Course recap; course evaluation.	

NOTE: The syllabus is subject to change.

Homework Note: Assigned homework problems with * designate problems that are to be checked with STAAD. The STAAD analysis is to be submitted with the homework, so that there will be a manual analysis solution and a STAAD analysis solution. Each STAAD solution is to include the following: (1) a thorough sketch of the structural model showing member numbers, joint numbers, member properties, material properties, etc.; (2) a complete STAAD input file; (3) a complete STAAD output file; (4) a summary comparison between the manual analysis and the STAAD analysis results.