UNIVERSITY OF PORTLAND
SCHOOL OF ENGINEERING

CE 441 - Structural Steel Design

(MWF 12:30-1:25)
Spring Semester 2008

INSTRUCTOR: Dr. Matthew R. Kuhn (Rm. ???, 943-7361, kuhn@up.edu)

OFFICE HOURS:

TEXTS: 1) (Required) American Institute of Steel Construction, *Steel Construction Manual*, 13th edition, 2005.

2) (Recommended) William T. Segui, *Steel Design*, Thomson, Toronto, 4th edition, 2007.

2) Several texts are on reserve in the library for 1-week use. See also section TA684 in library stacks.

COURSE LEARNING OBJECTIVES: Students will be prepared for work as an entry-level engineer in a structural engineering firm or agency. The course will

- develop a general design approach to structural engineering problems,
- introduce the loading provisions of the International Building Code that relate to structural design,
- introduce the elements of steel behavior that form the basis of the AISC design specification,
- introduce the LRFD method for designing the most common structural steel elements and their connections, both bolted and welded,
- involve students in a realistic design projects that develops communication and teamwork skills, and
- provide practice in the use of computers for structural analysis and design.

ASSESSMENT

Homework & quizzes	30 %	Homework 175 pts, Quizzes 30 pts.
Examination 1	20 %	
Examination 2	20 %	
Final Examination	30 %	

LEARNING OBJECTIVES AND OUTCOMES	ASSESSMENT
1. Knowledge and comprehension of structural engineering and steel design vocabulary and concepts a) can recall definitions of words in the course “vocabulary list" b) can recognize and explain terms listed in the course syllabus c) can recognize and distinguish among structural system for the seismic “Response Modification Coefficient" *R*	Quizzes
2. Application of structural engineering and steel design concepts with calculations a) can compute and distribute building dead loads b) can trace load paths through building structural systems with both gravity and lateral loads c) can compute, reduce, and factor floor live loads on a structural component for various occupancies d) can compute and factor wind loads on a simple building structure e) can compute and factor wind loads on a structural component f) can compute snow load for a structural component g) can compute seismic base shear of a building h) can vertically distribute seismic base shear among building roof and floor levels i) can horizontally distribute seismic shear among building lateral force resistance elements within a floor level j) can compute the factored loads and factored load effects for combined loads k) can select the lightest shape for a tension member with holes, including the effects of block shear l) can analyze the load paths and design the wind bracing in a simple braced-frame structure m) can compute the radius of gyration of a built-up column n) can use the column design tables to select a lightest column o) can use column alignment charts to find k-factors p) can select the lightest column with hand calculations q) can determine the gravity loads on a building column and select the lightest shape r) can design a continuous steel beam, by analyzing alternative live loadings using the elastic design method s) can design a beam for shear and deflection t) can design a simple floor joist (not considering composite action)	Homework Examinations Project

u) can design a beam in which lateral-torsional buckling must be considered v) can use design moment charts to design a beam for lateral-torsional buckling w) can design a building component to resist lateral-torsional buckling x) can use the composite design methods to design a multispan beam y) can analyze a beam-column using hand calculations z) can design a simple bolted connection, with and without load eccentricity aa) can design a simple fillet weld connection, with and without load eccentricity	
3. Integration of principles learned in previous structures courses a) can perform hand calculations to compute forces in a planar truss b) can compute the moments that result from eccentric loading c) can calculate the moment of inertia of a simple shape d) can use charts and superposition to compute shears and bending moments in indeterminate beams e) can recognize situations in which shear may control the design of a beam f) can recognize situations in which a column may actually be a beam column g) can recognize situations in which eccentric loading must be considered h) can compute the moment produced by load eccentricity	Homework Examinations
4. Application to the design of Swindells Hall a) can compute dead loads and distribute them to girders and columns b) can compute roof and floor live loads and distribute them to girders and columns c) can compute seismic base shear and distribute it to roof and floor levels d) can distribute seismic forces to lateral resistance elements using an approximate stiffness analysis e) can design building floor beams f) can use structural engineering software to analyze moment resistant frames	Project

Homework

Grade Descriptors for Homework:

Numerical grades will be assigned on each homework assignment, based on the following descriptors.

1. Proper selection and manipulation of pertinent equations 50%
2. Mathematical accuracy 25%
3. Presentation (see guidelines below) 25%

Guidelines on Homework Format:

1. You must work independently on all computer assignments. On other assignments, you may work with others, but give them credit on the cover page. Failure to give credit is discourteous and will be penalized 25%.
2. Homework is due at the beginning of class. Late homework will not be accepted.
3. Every homework assignment will count toward the final grade.
4. Include a cover page with each homework set.
5. Use either square grid engineering paper, blank (white) paper, or recycled paper.
6. Print on only <u>one side</u> of the paper.
7. Be neat. Present your calculations in an orderly, linear fashion, explaining important steps and assumptions.
8. When possible, give formulas in symbolic form <u>before</u> substituting numbers.
9. Whenever you think there may be confusion, explain steps in your calculations or use a diagram.
10. You do not need to rewrite the problem statement, but you should begin each problem with the following introduction:

    <u>Given:</u> Briefly summarize the conditions of the problem. Do <u>not</u> simply repeat the problem statement. This will include the numerical properties and data given in the problem statement. It should also include any numerical information that can be inferred from the problem statement. If you think that some necessary information was not given in the problem statement, then clearly state your chosen assumption.

    <u>Required:</u> Briefly describe what is required in your problem.

    <u>Calculations:</u> Your calculations.
11. Whenever possible, every number that you use in your calculations should be given <u>with its units</u>.
12. Underline the final answer, *with its units*. You should give your answer with an appropriate number of significant figures that is consistent with the precision of the given data and your idealizations.

Quizzes

Quizzes will be occasionally given, as shown in the lecture schedule. The quizzes will cover the vocabulary, which will be listed on a sheet to be distributed during the first week of class.

Examinations

You should not expect the examination questions to be the same as those given in the homework assignments. Just as each homework question requires different solution methods and concepts (rather than simply drill), examination questions will likely be different than those in homework assignments. Certain questions will test the student's insight in extending concepts to less common situations and in synthesizing concepts in this course with those from other courses.

There will be no make-up examinations and no credit for missed examinations. Cheating will result in forfeiting an examination.

Academic Integrity

The University's Code and Guidelines of Academic Integrity are available on the web (www.up.edu > Academics > Registrar > Academic Regulations). Students should read and be familiar with the code and guidelines and should be aware of the various types of violations: cheating, forgery, and plagiarism. In this course, all violations will be considered as being of Level 2 or higher.

Accomodation for Disability

If you have a disability and require an accommodation to fully participate in this class, contact the Office for Students with Disabilities (OSWD), located in the University Health Center (503-943-7314), as soon as possible.

If you have an OSWD Accommodation Plan, you should make an appointment to meet with Dr. Kuhn to discuss your accommodations. Also, you should meet with Dr. Kuhn if you wish to discuss emergency medical information or special arrangements in case the building must be evacuated.

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Syllabus
Spring Semester 2008

No.	Date	Topics	H.W. No. (due) pts
1	1/14	Introduction	No. 1
		International Building Code	(3) 10pts
		Dead and live loads	
2	1/16	Dead and live loads, cont.	
		Snow and wind loads	
3	1/18	Wind loads, cont.	No. 2
		Seismic response spectra	(5) 10pts
4	1/21	Seismic loads	
5	1/23	Seismic loads, cont.	No. 3
			(7) 10pts
6	1/25*	Seismic loads, cont.	
		Structural steel	
		Tensile stress-strain behavior	
		Types of steel	
		Residual stresses	
7	1/28	Common sections and section properties	No. 4
		Standard mill practice	(11) 15pts
8	1/30	**Design philosophy in LRFD**	
		Load factors	
		Resistance factors	
		Limit states	
		Serviceability	
9	2/1*	**Tension members**	
		Behavior	
		Net and gross areas	
10	2/4	Effective net area	No. 5
		Stiffness	(13) 20pts
		Design examples	
11	2/6	Block shear	
12	2/8	**Compression members**	
		Euler buckling strength	
		Modifications to theory	
		Basic column strength	

13	2/11	Column load tables Effective length	No. 6 (16) 20pts
14	2/13	Column design in braced frames Alignment charts for braced frames	
15	2/15	Braced frame examples	
16	2/18*	Seismic design, cont.	No. 7 (19) 10pts
17	2/20	**Flexural members** Bending of symmetric sections Plastic modulus and plastic moment Shear strength	
18	2/22	*Examination No. 1*	
19	2/25	Deflections Compactness criteria Examples	No. 8 (22) 20pts
20	2/27	Beam examples, cont. Lateral buckling	
21	2/29	Lateral buckling, cont.	No. 9 (24) 10pts
22	3/3	Examples: elastic design, considering lateral buckling	
23	3/5	Composite design concepts	
24	3/7*	Composite design examples	No. 10 (27) 10pts
25	3/17	Composite design examples	
26	3/19	**Beam columns** Behavior Design concepts	
27	3/26	Design examples Unbraced frames	No. 11 (30) 15pts
28	3/28	Design examples, cont. **Bolted connections** Bolt types	
29	3/28	Bolt installation Tension and shear strength	
30	4/2*	Bearing and edge distance Design examples	No. 12 (33) 15pts
31	4/4	Design examples, cont. Slip critical design strengths	
32	4/7	*Examination No. 2*	
33	4/9	**Welded connections** Welding processes	

34	4/11	Welding symbols Welding inspection	
35	4/14	Fillet weld strength	No. 13 (37) 10pts
36	4/16*	**Connection design** Eccentrically loaded connections	
37	4/18	Shear (Partially Restrained, PR) connection design	
38	4/21	Shear connection design, cont.	
39	4/23	Moment (Fully Restrained, FR) connection design	
40	4/25	Course review	

4/28 (Mondayday)
1:30-3:30 Final Examination

* Quiz dates