CE 172  STRUCTURAL STEEL DESIGN
Fall Semester - 2017

Time: TR 10:05 – 11:20 AM         Class Room: VOTEY 207      Course Website: Blackboard

Instructor: Dr. Priyantha Wijesinghe
Office: VOTEY 113
Phone: (802) 656-3305
E-mail: pwijesin@uvm.edu
Office Hours: M & F 11 AM - noon, T & R 8:30 – 9:30 AM, W 4:30 - 6 PM or by appointment

COURSE CATALOG DESCRIPTION:

CE 172 Structural Steel Design. Theory and design of steel structures including flexural members, axially loaded members and combined stress members; design of composite members; and plastic analysis and design. Pre/co-requisite: CE 170.

COURSE OBJECTIVES:

Overall
The fundamental principles behind the analysis and design of modern steel structures are studied in this course with the emphasis given to the design of steel members. The relationship between applied loads and their effect on steel structures are studied with a basic understanding of various modes of failure of steel members. Analysis and design of tension members, compression members, flexural members, combined stress members, simple connections and composite members are studied. The course covers the concepts of both Load and Resistance Factor Design (LRFD) and Allowable Stress Design (ASD) methods in accordance with the 15th edition of AISC Steel Construction Manual.

Specific Learning Objectives

1. Identify steel as a structural material, review its material properties and learn different geometric shapes (hot-rolled and cold-formed)
2. Learn the specifications, loads and design philosophies (ASD and LRFD)
3. Analysis and design of tension members for yield, fracture and block shear
4. Analysis and design of compression members accounting for buckling and yield
5. Apply plastic analysis to steel I beams
6. How to account for lateral/torsional buckling of beams in analysis and design
7. Integrating considerations for shear, compact requirements, and deflection limits
8. Consideration of combined stresses to do bending and axial load
9. Analysis and design of simple connections
10. Analysis of composite beams and columns (if time permits)

TEXTBOOK (required):


STEEL MANUAL (required):

Note:
Students enrolled for this course can purchase this manual through the instructor for the price of $145 when purchased through the AISC Student Discount Program. The coupon code and the website will be provided on the first day of class.

REFERENCE BOOKS:

GRADING:

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<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>RATs (Readiness Assessment Tests) and Quizzes</td>
<td>10% (will be assigned periodically)</td>
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<tr>
<td>Homework</td>
<td>20% (will be assigned periodically)</td>
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<tr>
<td>Midterm Exams</td>
<td>30% (two hour exams, each counts 15%)</td>
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<td>Group Project</td>
<td>15%</td>
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<tr>
<td>Final Exam (comprehensive)</td>
<td>25% (due during finals week)</td>
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<td><strong>Total</strong></td>
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The minimum passing grade is 60%. Other grades will be assigned as shown below.

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<tr>
<th>Letter Grade</th>
<th>Numerical Grade</th>
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<tr>
<td>A+</td>
<td>97-100</td>
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<td>A</td>
<td>94-97</td>
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<td>A-</td>
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A statistical scale may be used at instructor’s judgment in addition to the above scale.

EXAM AND HOMEWORK POLICIES:

Make-up exams will be given at the discretion of the instructor, and appropriate documentation of absence will be required for consideration of a make-up exam. It is strongly encouraged to obtain prior permission from the instructor.

Homework assignments will be assigned weekly and will be posted in the class website. All assignments will be collected at the beginning of class. No late homework will be accepted and there will be no make-RATs or quizzes.
### COURSE OUTLINE

#### 1.0 Introduction to Structural Steel Design *(text chapter 1)*

1.1 Steel as a Structural Material *(text sections 1.1 & 1.2)*

1.2 Steel Sections (Hot-rolled and Cold-formed) *(text sections 1.4 & 1.6)*

1.3 Properties of Structural Steel (Stress-Strain Relationship etc.) *(text sections 1.7, 1.10 & 1.12)*

1.4 Types of Structural Steel *(text sections 1.8 & 1.9)*

1.5 Design of Steel Members *(text sections 1.13 - 1.17)*

#### 2.0 Specifications, Loads and Design Philosophies *(text chapter 2)*

2.1 Specifications and Building Codes *(text section 2.1)*

2.2 Loads (Dead Load, Live Load and Environmental Loads) *(text sections 2.2 - 2.5)*

2.3 Allowable Strength Design (ASD) *(text sections 2.6-2.11)*

2.4 Load and Resistance Factor Design (LRFD) *(text sections 2.6-2.11)*

2.5 Safety Factor and Resistance Factor *(text sections 2.12-2.13)*

#### 3.0 Analysis and Design of Tension Members *(text chapters 3 & 4)*

3.1 Introduction *(text sections 3.1 - 3.2)*

3.2 Net Area and Gross Area *(text section 3.3)*

3.3 Tensile Strengths *(text section 3.2)*

3.4 Effective Area *(text section 3.5)*

3.5 Staggered Holes *(text section 3.4)*

3.6 Block Shear *(text section 3.7)*

3.7 Design of Tension Members *(text section 4.1)*

3.8 Rods and Bars *(text section 4.3)*

3.9 Tension Members in Roof Trusses *(text section 4.3)*

#### 4.0 Analysis and Design of Axially Loaded Compression Members *(text chapters 5 - 7)*

4.1 Introduction *(text sections 5.1 & 5.3)*

4.2 The Euler Formula *(text section 5.5)*

4.3 Effective Lengths of Columns *(text section 5.6)*

4.4 Local Stability *(text section 5.7)*

4.5 Long, Short and Intermediate Columns *(text section 5.8)*

4.6 AISC Column Formulas *(text section 5.9)*

4.7 Design of Compression Members *(text section 6.1 & 6.2)*

4.8 Further Discussion of Effective Lengths *(text section 7.1 & 7.2)*

4.9 Flexural-Torsional Buckling *(text section 6.10)*

4.10 Design of Column Base Plates *(text section 7.6)*

#### 5.0 Analysis and Design of Flexural Members *(text chapters 8 - 10)*

5.1 Introduction and Types of Beams *(text sections 8.1 - 8.6)*

5.2 Plastic Analysis *(text sections 8.7 - 8.10)*

5.3 Bending Strength of Compact Shapes *(text sections 9.2 - 9.8)*

5.4 Bending Strength of Noncompact Shapes *(text section 9.9)*

5.5 Shear Strength *(text section 10.2)*

5.6 Deflection *(text section 10.3)*

5.7 Design

5.8 Floor and Roof Framing Systems
6.0 Design of Beam-Columns (text chapter 11)
   6.1 Introduction (text sections 11.1 & 11.2)
   6.2 Magnification Factors (text section 11.4)
   6.3 Moment Modification Factors (text section 11.5)
   6.4 Braced Vs Unbraced Frames (text section 11.7)
   6.5 Members in Braced Frames (text section 11.6)
   6.6 Members in Unbraced Frames (text section 11.8)
   6.7 Design of Beam Columns (text section 11.7)

7.0 Design of Simple Connections (text chapters 12 - 15)
   7.1 Introduction
   7.2 Bolted Connections (text sections 12.1 - 12.14)
   7.3 Welded Connections (text sections 14.1 - 14.8)
   7.4 Eccentric Bolted and Welded Connections (text chapter 13)
   7.5 Moment-Resisting Connections (text section 15.11)

Disabilities
In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact SAS, the office of Student Accessibility Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated in an accommodation letter to faculty. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. Contact SAS: A170 Living/Learning Center; 802-656-7753; access@uvm.edu; or www.uvm.edu/access.

Academic Integrity
Offences against the Code of Academic Integrity are deemed serious and insult the integrity of the entire academic community. Any suspected violations of the code are taken very seriously and will be forwarded to the Center for Student Ethics & Standards for further intervention. To read the Code of Academic Integrity and learn more about the Center for Student Ethics & Standards, visit their website at: https://www.uvm.edu/policies/student/acadintegrity.pdf

Health and Wellbeing
The Center for Health & Wellbeing (CHWB) offers a wide range of services to support your mind, body, and soul while you're at UVM. The Student Health Services staff of board certified physicians, physician assistants, nurse practitioners, nurses, and dietitians work with patients and collaborate with other CHWB providers to ensure personalized and timely care to UVM students. Counseling & Psychiatry Services (CAPS) offers short-term individual counseling, urgent needs counseling, group counseling, outreach and education, psychiatry, referrals, and consultation services. Please visit their website at: http://www.uvm.edu/~chwb/ to find out more.

At Living Well they believe that mental and physical health go hand in hand. They have a variety of programs that offer you the space to create a wellness practice that will support your goals and positive intentions. I highly recommend you to visit their LivingWell website at http://www.uvm.edu/~chwb/livingwell/ and checkout the meditation and yoga videos. Extensive research has shown the benefits of meditation towards the learning process. http://www.huffingtonpost.com/2013/04/08/mindfulness-meditation-benefits-health_n_3016045.html