CE 172 STRUCTURAL STEEL DESIGN (Project-Based) (3-credit)

Fall Semester - 2020

Mode of Instruction: MIXD
Class Room: ALUMNI HOUSE SILVER PAVILION 142
Time and Meeting Pattern:
Tuesday Group attends on Tuesdays 2:50 – 4:05 PM
Thursday Group attends on Thursdays 2:50 – 4:05 PM
Note: Group list is posted on Blackboard (Bb) under announcements and on the last page of this document

Instructor: Dr. Priyantha Wijesinghe
Office: VOTEY 235A
E-mail: pwijesin@uvm.edu
Office Hours: M & F 9 – 10 AM and W 3 – 5 PM or by appointment. Office hours will be held via MS Teams. Join MS Teams meetings during these times.

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; project-based. Prerequisite: 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 and simple connections are studied. The group design project involves designing a real-world multi-story structure and analyzing it using SAP2000. 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 Outcomes and Objectives:

Upon completion of *CE 172 Structural Steel Design*, students will be able to:

1. Identify steel as a structural material; review its material properties and identify different geometric shapes (hot-rolled and cold-formed)
2. Explain the specifications, loads and design philosophies, discuss the difference between ASD and LRFD methods
3. Analyze and design tension members for yield, fracture and block shear
4. Analyze and design compression members for buckling and yield
5. Apply plastic analysis to steel I beams
6. Apply lateral/torsional buckling to analyze and design beams
7. Integrate the considerations for shear, compact requirements, and deflection limits
8. Design for combined stresses under bending and axial load
9. Design and analyze simple connections
10. Design and analyze a real-world structure using SAP2000 and verify the analysis results using hand calculations

RELATIONSHIP TO ABET STUDENT OUTCOMES (Criterion 3)

Level of Instruction (1-2) *M: moderate* *H: High*	***Outcome #***	***ABET Outcome***
H	*1*	*an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*
M	*2*	*an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors*
M	*5*	*an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives*
M	*7*	*an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*

TEXTBOOK (recommended):

Structural Steel Design by Jack C. McCormac, 6th Edition, Prentice Hall, 2018.

STEEL MANUAL (required):

AISC Steel Construction Manual, 15th Edition, American Institute of Steel Construction, Inc.

Note:
Students enrolled for this course can purchase this manual through the instructor for the price of $135 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:

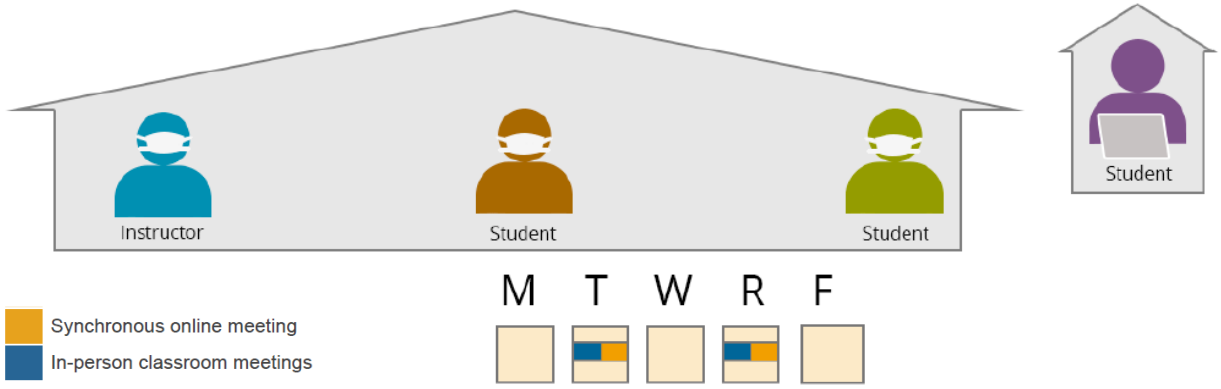
- Steel Design by William T. Segui, 6th Edition, Cengage Learning, 2018.
- Steel Structures: Design and Behavior by Charles G. Salmon, John E. Johnson and Farris A. Malhas, 5th Edition, Prentice Hall, 2009.

PEDAGOGY

Students will be led through a review of reading and readiness assignments, case studies and several example problems in each lecture period with opportunities to pause, reflect, and comment on what they've learned. Students will work in small groups duirng class and actively involve in their own leaning. The classroom response system, Top Hat will be used in each lecture for clicker questions, groups discussions and chats to promote active student engagemnet. Physical models and simulations will be used to demonstrate key concepts. New topics will be grounded in real world examples and case studies throughout. Students will actively participate in their group project throughout the semester.

MEETING PATTERN, ATTENDANCE AND CLASSROOM EXPECTATIONS

This course is delivered in the mixed mode. Students are divided into two groups (Tuesday Group and Thursday Group). You will find your group assignment at the end of this document and on Bb announcement page. Please check your group before coming to class.
The syllabus and the class schedule are posted on Bb under *Syllabus* tab.



Classroom Environment Expectations:

The Green and Gold Promise clearly articulates the expectations that UVM has for students, faculty, and staff to remain compliant with all COVID-19 recommendations from the federal CDC, the State of Vermont, and the City of Burlington. This include following all rules regarding facial coverings and social distancing when attending class. If you do not follow these guidelines, I will ask you to leave the class. If you forget your mask, you cannot enter the class and should go back and retrieve your mask. The Code of Student Conduct outlines policies related to violations of the Green and Gold Promise. Sanctions for violations include fines, educational sanctions, parent notification, probation, and suspension.

Quarantine / Isolation:

If you need to isolate or quarantine, Student Health Services will inform the Dean's office. I recommend contacting me and the CEMS Office of Student Services as early as possible to make arrangements to discuss any missed work. I expect you to continue your work while in quarantine as this course is delivered in the MIXD mode.

Recording Class Sessions:

Our class sessions will be audiovisually recorded for students in the class to refer back to, and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live.

GRADING:

Class attendance, participation and clicker questions	10% (via *Top Hat*)
Homework and Case Study Quizzes	20% (will be assigned periodically)
Midterm Exams	20% (two, hour exams, each counts 10%)
Group Project	30%
Final Exam (comprehensive)	20% (due during finals week)

Total	100%

The minimum passing grade is 60%. Other grades will be assigned as shown below.

Letter Grade	Numerical Grade
A+	97-100
A	94-97
A-	90-93
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	<60

A statistical scale may be used at instructor's judgment in addition to the above scale.

EXAM AND HOMEWORK POLICIES:

All exams will be timed and delivered through Bb and will not be proctored. 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 prier permission from the instructor. Additional instructions will be posted on Bb a week prior to the exam date.

Homework assignments will be assigned weekly and will be posted on Bb. All homework assignments must be submitted **electronically as a single PDF file** (unless noted otherwise) using the correct Bb assignment link before they are due. Email submissions will not be accepted. You are required to follow the guidelines and the HW format posted on Bb to prepare your solutions. No late assignments will be accepted and there will be no make-up quizzes and no make-up "in-class' questions and activities.
If you do not have access to a scanner, please use Genius Scan (on iOS) or TinyScanner (on Android) to convert your hand-written solutions to pdf.

COURSE OUTLINE

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

- 1.1 Steel as a Structural Material *(text sections 1.1-1.3)*
- 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 Design Philosophies *(text sections 2.6-2.11)*
2.4 Allowable Strength Design (ASD) *(text sections 2.6-2.11)*
2.5 Load and Resistance Factor Design (LRFD) *(text sections 2.6-2.11)*
2.6 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)*

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

5.1 Introduction and Types of Beams *(text sections 8.1 - 8.3)*
5.2 Plastic Analysis *(text sections 8.4 - 8.8)*
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 11.7)*
6.6 Members in Unbraced Frames *(text section 11.8)*
6.7 Design of Beam Columns *(text section 11.9)*

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)*

REQUIRED SOFTWARE AND PLATFORMS:

Please read this technology check list to make sure you are ready for classes.
https://www.uvm.edu/it/kb/student-technology-resources/
Students should contact the Helpline (802-656-2604) for support with technical issues.

Important: Students are required to bring their laptops to class every day. Physical interaction and verbal communication in class maybe restricted due to physical distancing and masks. Be prepared to interact with your peers via technology that are listed below.

This course uses resources in different formats. Please make sure that you can open a PDF document and watch a YouTube video. Adobe Acrobat Reader is needed to view PDF documents. If you do not have adobe reader on your computer you can download it for free from the Adobe website at http://www.adobe.com.

Blackboard (Bb):

Make sure you are using a supported browser to access Blackboard (Bb). To check your browser and for more help on using Bb, please follow this link. Additionally, bookmark UVM Tech Team Knowledge Base to get UVM-specific information, and to get one-on-one help, if needed.
Bb will be used to (a) deliver, collect and grade homework assignments and exams, (2) post grades, and (3) post weekly announcements. All other course materials will be posted on Top Hat.

Top Hat

We will be using Top Hat Pro (www.tophat.com) for (1) class participation, (2) attendance and (3) organization of course materials. Class participation includes, clicker questions, short quizzes, discussions and chats. Lectures and supplementary materials will also be posted on Top Hat as weekly modules.

Top Hat Pro requires a paid subscription, and a full breakdown of all subscription options available can be found here: www.tophat.com/pricing.
You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. You can visit the Top Hat Overview (https://success.tophat.com/s/article/Student-Getting-Started-with-Top-Hat) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.
An email invitation will be sent to you by email, but if you do not receive this email, you can register by simply visiting our course website:
https://app.tophat.com/e/593918
Note: our Course Join Code is **593918**
Should you require assistance with Top Hat Pro at any time please contact their Support Team directly by way of email (support@tophat.com), the in-app support button, or by calling 1-888-663-5491. Specific user information may be required by their technical support team when troubleshooting issues.

MS Teams
MS Teams will be used to (1) deliver synchronous lectures and (2) hold weekly office hours. Please follow this link for instructions to download MS Teams. When you login, you should be able to see *CE172A Structural Steel Design* MS Team.

SAP2000
SAP2000 is a structural analysis software that you will use for the group design project. You can access SAP2000 via Virtual Votey. Please follow these instructions to connect.

NETIQUETTE
Netiquette stands for Network Etiquette. It refers to proper behavior while interacting online. The golden rule of netiquette is essentially to treat people as you would want to be treated. Please be polite and considerate. Think about whether your comment could cause hurt feelings. Be careful about how your words can come across because misunderstandings can be common online. Read this to learn more about netiquette.

INCLUSIVE LEARNING ENVIRONMENT
I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

ACADEMIC INTEGRITY

Offences against the **Code of Academic Integrity** are deemed serious and insult the integrity of the entire academic community. This policy addresses plagiarism, fabrication, collusion, and cheating. https://www.uvm.edu/sites/default/files/UVM-Policies/policies/acadintegrity.pdf (PDF link). Any suspected violations of the code are taken very seriously and will be forwarded to the Center for Student Conduct for further intervention.
Code of Student Conduct:
https://www.uvm.edu/policies/student/studentcode.pdf (PDF link)

COVID-19 POLICY STATEMENTS

General statement regarding potential changes during the semester:
http://catalogue.uvm.edu/
The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

Green and Gold Promise:
The Green and Gold Promise clearly articulates the expectations that UVM has for students, faculty, and staff to remain compliant with all COVID-19 recommendations from the federal CDC, the State of Vermont, and the City of Burlington.
The Code of Student Conduct outlines policies related to violations of the Green and Gold Promise. Sanctions for violations include fines, educational sanctions, parent notification, probation, and suspension.

Intellectual Property Statement/Prohibition on Sharing Academic Materials:
Students are prohibited from publicly sharing or selling academic materials that they did not author (for example: class syllabus, outlines or class presentations authored by the professor, practice questions, text from the textbook or other copyrighted class materials, etc.); and students are prohibited from sharing assessments (for example homework or a take-home examination). Violations will be handled under UVM's Intellectual Property policy and Code of Academic Integrity.

STUDENT LEARNING ACCOMMODATIONS:
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 to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan. Contact SAS: A170 Living/Learning Center: 802-656-7753 (phone link).

Contact Student Accessibility Services (SAS):
A170 Living/Learning Center
802-656-7753 (phone link)
access@uvm.edu (email link)
https://www.uvm.edu/academicsuccess/student_accessibility_services

UVM's policy on disability certification and student support:
https://www.uvm.edu/policies/student/disability.pdf (PDF link) (PDF link)

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

COUNSELING & PSYCHIATRY SERVICES (CAPS)
Phone: (802) 656-3340
If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at https://www.uvm.edu/deanofstudents.
Counseling and Psychiatry Services: https://www.uvm.edu/health/CAPS

TIPS FOR SUCCESS:

Course-specific study/preparation tips

Checklist for success in https://learn.uvm.edu/about/support-for-students/checklist-online-credit-courses/

- Academic support for online courses: https://www.uvm.edu/academicsuccess/online-learning-student-resources-remote-instruction
- 30-minute webinar on online learning success (Mar 2020): https://www.youtube.com/watch?v=Xp_MYsqQyvE

Helpful resources other than the professor (e.g. Undergraduate/Graduate Writing Center, Supplemental Instruction, Learning Co-op tutors, supplemental course materials)

RELIGIOUS HOLIDAY POLICY STATEMENT

Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the first week of classes. You will be permitted to make up work within a mutually agreed-upon time.

GRADING:

Your grades will be posted on Bb. Please check your grades frequently and notify me if you find any mistakes.

For information on grading and GPA calculation, go to the Registrar's page on grading. https://www.uvm.edu/registrar/grades .

GRADE APPEALS:

If you would like to contest a grade, please follow the procedures outlined in this policy: https://www.uvm.edu/policies/student/gradeappeals.pdf (PDF link)

FERPA RIGHTS DISCLOSURE:

The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974. https://www.uvm.edu/policies/student/ferpa.pdf (PDF link)

FINAL EXAM POLICY:

The University final exam policy outlines expectations during final exams and explains timing and process of examination period. https://www.uvm.edu/registrar/final-exams

STATEMENT ON ALCOHOL AND CANNABIS IN THE ACADEMIC ENVIRONMENT

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

- Cause issues with attention, memory and concentration
- Negatively impact the quality of how information is processed and ultimately stored
- Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.