CE 597.1: Design of Steel-Concrete Composite Structures

Course Run

CE 597.1: Design of Steel-Concrete Composite Structures (Spring 2021)

Instructor

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Teaching Assistant

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Audience

This is a graduate level course for graduate students or practicing engineers with some background in the design of steel structures including beams, columns, and frames.

Course Description

This course will cover fundamental concepts and applications of steel-concrete composites in the design of steel buildings and bridges with emphasis on composite beams and floor systems, composite columns, and composite walls. At the end of the course, the student will have an in-depth knowledge of relevant limit states / failure mode in steel components and structures, and a familiarity with the applicable topics in the AISC and AASHTO Specifications and their basis in research / testing. The students will have some experience in solving design examples and looking at applications of the fundamental concepts learned in the course.

Course Learning Outcomes

After completing this course, you will be able to:

- Define composite action and describe the effect composite action has on structural component behavior
- Describe and assess the limit states governing composite beam, column, and wall design.
- Design composite beams, columns, and walls using AISC 360

Required Text and Materials

1. The course will follow the contents of the book:
   Segui, W.T. (2017). *LRFD Steel Design*. 6th Edition, Brooks/Cole Publishing Company, Pacific Grove, California.
2. Steel structures will be designed according to:

AISC (2016). *Specification for Structural Steel Buildings*, American Institute of Steel Construction, Chicago, IL.

3. Selected structural steel components will be designed and/or evaluated using:
   AISC (2016). *Steel Construction Manual*, Fifteenth Edition, American Institute of Steel Construction, Chicago, IL.
   AASHTO LRFD Bridge Design Specifications 8th Edition, American Association of State Highway & Transportation Officials, Washington, DC.
4. Some other books and references on the behavior and design of steel structures that are in the library:
   a) Salmon, C.G. and Johnson, J.E. (1996). *Steel Structures: Design and Behavior, Emphasizing Load and Resistance Factor Design*, 4th Edition, Harper College Publishers, New York, NY.
   b) ASCE/SEI 7-16. (2016). *Minimum Design Loads for Buildings and Other Structures.* American Society of Civil Engineers. Reston, VA
   c) IBC (2012). *International Building Code*, International Code Council. Falls Church, VA.
   d) The software that will be preferred for analyzing structures in this course will be Mastan 2, which can be downloaded from www.mastan2.com for free. OR SAP 2000 can be used
5. Homework problems are adapted from:
   a) Geschwindner, L. F., Liu, J., & Carter, C. J. (2017). *Unified Design of Steel Structures* (3rd ed.). State College, PA: Providence Engineering Corp.

Prerequisites

None

Homework policy

Homework assignments are expected to be turn in to Gradescope in a pdf format. Homework assignments should be neat and easy to read. We recommend using Mathcad or a similar program.

Grading

This course will be graded based on the following criteria:

Assessment Type	Description	% of Final Grade
Homework (6)	Six homework assignments will be assigned throughout the course. These assignments include 1-2 problems for students to work out.	60%
Quiz (3)	Quizzes cover composite beams, columns, and walls. Quizzes are multiple choice/true false and include knowledge and computation questions.	15%
Final Exam	The final exam is cumulative and consists of 10 multiple choice/true false questions and two long answer problems.	25%

Course Content and Activities

Week	Module	Activities & Assignments
1	1.1 Welcome and Introduction 1.2 Full Composite Action	Video Lectures Homework 1 due **January 28, 11:59pm ET** *(January 29 4:59am UTC).*
2	2.1 Metal Decks and Shear Connectors 2.2 Composite Beam examples	Video Lectures Quiz 1 Homework 2 due **February 4, 11:59pm ET** *(February 5, 4:59am UTC)*
3	3.1 Deflection and Design Tables	Video Lectures Quiz 2 Homework 3 due **February 11, 11:59pm ET** *(February 12, 4:59am UTC)*
4	4.1 Introduction to Composite Columns 4.2 Column Strength and Column Curves 4.3 Column Examples	Video Lectures Quiz 3 Homework 4 due **February 18, 11:59pm ET** *(February 19, 4:59am UTC)*
5	5.1 Flexural Capacity of Filled Composite Members 5.2 P-M interaction of Filled Composite Members	Video Lectures Homework 5 due **February 25, 11:59pm ET** *(February 25, 4:59am UTC)*
6	6.1 Introduction to Composite Walls 6.2 Applications and Construction of Composite Walls	Video Lectures
7	7.1 Experimental Behavior of Composite Walls 7.2 Design Requirements for composite Walls 7.3 Design Example and Calculations for Composite Walls	Video Lectures Homework 6 due **March 11, 11:59pm ET** *(March 12, 3:59am UTC)*

8	8.1 Review for Final	Final exam

Estimated Effort

- 5 hours/week
- 8 weeks total

Languages

Content: English | Videos: English | Transcripts: English

Course Difficulty

This course will not be difficult for students with adequate preparation, which consists of a civil engineering undergraduate degree and a basic (undergrad level) steel design course that has covered the design of tension members and fasteners.

Accessibility Support

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let an instructor know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: mailto:drc@purdue.edu or by phone: 765-494-1247.

Visit edX's Website Accessibility Policy for information about accessibility on edX.

Course Help

To get help with course content, click the Discussion tab and post a question in "Course Q&A". By commenting in the pinned discussion post, the course team will be able to respond to your question more quickly.

Technical Help

For general questions about using the edX platform, please refer to these resources:

- Technical Documentation: https://docs.edx.org
- Learner Help Center: https://support.edx.org/hc/en-us
- To get help with a technical problem, visit the *Help* link to contact edX Support.

Discussion Guidelines

Please follow the Discussion Guidelines when contributing to discussions in this course. Here are a few of the key points you should remember:

- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an "open-mind" and be willing to express even your minority opinion.
- Make substantive posts or comments. Avoid comments that do not contribute to the discussion, like "thanks" or "good post."
- Do not hesitate to ask for feedback.
- Be concise and to the point. Give other students the opportunity to join in the discussion.
- Think and edit before you push the "Send" button.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

The Purdue Honor Pledge

"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Link to Purdue's nondiscrimination policy statement.