

# CE 2343: Structural Analysis

## Department of Civil Engineering

### General Information

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| Instructor:                | Jeff Weidner, Ph.D.<br>Office: A-222<br>Lab: E-214<br>Office Phone: (915)-747-6913<br>Email: <a href="mailto:jweidner@utep.edu">jweidner@utep.edu</a><br>Office Hours: By appointment – Schedule at <a href="http://weidner.acuityscheduling.com">weidner.acuityscheduling.com</a>   |
| Teaching Assistant:        | Sarah Ballard<br>Email: <a href="mailto:sballard@miners.utep.edu">sballard@miners.utep.edu</a><br>Office: E-214<br>Office Hours: By Appointment  |
| Meeting Time and Location: | Tuesday/Thursday: BUSN 301 – 9:00AM to 10:20PM   |
| Final Exam:                | Tuesday December 11, 2018 – 10:00AM-12:45PM  |
| Course Description:        | From the university course catalog:<br>A study of framed structures, trusses, girders, beams including applications of static and moving loads and bridges<br>My description:<br>A study of structural forms, components, actions, and responses stemming from various loading scenarios including both classical and computer (finite element modeling) solution approaches with a focus on current practice and trends.  |
| Class Approach:            | Lectures will come in many different forms. I will deliver some lectures on an iPad which mirrors to the projector, some on the chalkboard in a traditional format, and some will be PowerPoint. We will also do the occasional group work or in-class problem sessions. I have no issues with you using technology during lecture, but I ask that you silence your phone, and that you do not record the lecture.<br>This term we will be exploring Piazza as a communication platform. I will enroll you and you will get free access to the platform. I will also attempt to integrate it into Blackboard. Piazza works like Wikipedia, meaning that it is community driven. You can ask a question and the entire class can edit the response. It also has the ability to conduct polls and use private messaging. Throughout the term, I hope that Piazza leads to valuable discussions between students and also with the teaching assistants and myself. Anonymous posting will be permitted, but any sort of disrespect, mistreatment, or cheating will not be permitted and will be treated as a violation of student conduct. I will use Blackboard to provide you |

with announcements, assignments, class materials, and other related information, as well as grades.

Periodically I will seek your opinion on the class and my approach through anonymous surveys. I encourage you to be open and honest in the surveys.

Textbook: Required: Hibbeler, R.C. "Structural Analysis" 10<sup>th</sup> Edition

Course Objectives: By the end of this course you should be able to:

1. Identify structural form, components, applicable loads, and requisite analysis assumptions
2. Rapidly assess simple structures for stability and determinacy (review)
3. Apply mechanics principles to solve static equilibrium problems (review)
4. Solve for forces in statically determinate trusses (review)
5. Draw shear and moment diagrams for beams and frames (review)
6. Draw influence lines for reactions, forces, shears and moments
7. Determine internal forces in arches and cables
8. Estimate deflections in beams, frames, and trusses
9. Solve for simple statically indeterminate structures using classical methods
10. Develop an understanding of current structural engineering practice
11. Document structural calculations and understand the responsibility of an engineer
12. Use the internet as a resource to obtain information in support of structural analyses
13. Use and interpret results of structural analysis software
14. Understand the role of structural engineers in the development of a sustainable future

This course is designed with two primary goals, First, I want to prepare all engineering students to succeed in the structural analysis portion of the Fundamentals of Engineering exam. Second, I want to generate interest and enthusiasm for structural analysis in both students who are pursuing a structures track, and those who are not.

The first goal is achieved primarily through items 1-9, which compares directly with the coverage of the FE exam as indicated by NCEES, included below:

- Analysis of forces in statically determinate beams, trusses and frames
- Deflection of statically determinate beams, trusses and frames
- Structural determinacy and stability analysis of beams, trusses and frames
- Loads and load paths (e.g., dead, live, lateral, influence lines and moving loads, tributary areas)
- Elementary statically indeterminate structures

The second goal is addressed through my approach to teaching and the course activities planned.

## Class Policies

- Honor Code:** Students are expected to adhere to the Honor Code of the Department of Civil Engineering, which can be found here (<http://ce.utep.edu/honorcode.htm>). Instances of suspected cheating or other violations of the Honor Code will be handled according to the procedures in the UTEP Handbook of Procedures.
- Attendance Policy:** I do not take attendance during class. Your work is your responsibility, and you make the decision to show up in person or not. I do not promise to provide all class material in a timely fashion online. Homework will generally be assigned in class and posted/distributed online. See the class approach for information about online resources. If you do not show up you may miss quizzes. Makeup quizzes will not be given without an excused absence (e.g., a doctor's appointment with a note). Validity of excused absences is at my discretion and are not debatable. If you have a valid excuse to miss class and are concerned about missing material, please discuss with me in **advance**. Student athletes should speak with me at the start of the term to work out a plan for expected absences.
- Neatness Policy:** Part of being an engineer is executing tasks in a neat, understandable and repeatable manner. This is a critical aspect of engineering education that is often overlooked. In this class, I require you to:
- Complete homework assignments on engineering paper (available in the bookstore or on Amazon). **Loose-leaf paper is not permitted.**
  - Use sharp pencils and a straight-edge for your work. Write precisely and neatly.
  - Include your name on every page of your homework.
  - Number, title and date the pages of your homework.
  - Clearly sketch out any diagrams with labels as required.
  - Box answers so they can be readily identified.
  - List any external references used in the homework (i.e., textbook tables)
  - Make a clean digital copy for submission
- Violation of this policy will result in a deduction of up to 25% per assignment.
- Group Work Policy:** Working in groups is encouraged for homework assignments, but everyone must submit their own work. Blatant copying is not permitted and both the copier and the person who provided their work to be copied will lose credit for the assignment.
- Computer Policy:** When explicitly required by the instructor, homework assignments must be checked using a contemporary structural analysis software package (STAAD and RISA are provided by ETC). If the output from a computer analysis is not submitted when required, no credit will be given for the assignment. Please see ETC to ensure that you have access to STAAD and/or RISA. If you prefer to use another software, please consult with Dr. Weidner BEFORE turning in a homework assignment using that software.

Calculator Policy: Only NCEES approved calculators will be permitted, as these are what is allowed for the Fundamentals of Engineering exam. Visit the NCEES website (<http://ncees.org/exams/calculator/>) for more information. No phones.

## Coursework and Grading Expectations

Grading: Grade Breakdown:

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|-----------|--|
| Exams:    | 10% for Mid-term 1<br>10% for Mid-term 2<br>10% for Mid-term 3<br>20% for Final Exam |
| Quizzes:  | 10%  |
| Projects: | 20%  |
| Homework: | 20%  |

Final Grade Thresholds:  $A \geq 89.5$   
 $89.5 > B \geq 79.5$   
 $79.5 > C \geq 69.5$   
 $69.5 > D \geq 59.5$   
 $59.5 > F$

Exams: Exams will be in-class and closed book. I make the exam questions up myself, and do not reuse questions. Makeup exams are only provided after **advance** discussion with me. If you miss an exam due to unexpected circumstances (e.g., car crash, family emergency, etc.), notify me immediately and we will discuss options.

The final exam is cumulative. I am looking to see improvement in your capabilities as the term progresses. As such, I will replace your lowest exam score from all prior exams with your final exam grade, assuming that the final exam grade exceeds your prior scores.

Extended exams (longer than the allotted class period) are only provided through the Center for Accommodations and Support Services (<https://www.utep.edu/student-affairs/cass>). This includes exceptions that result from acute events that occur throughout the term.

Quizzes: Quizzes will be at the beginning of some classes. They will be one problem and will generally take ten minutes or less. I do not take attendance, but obviously if you are not in class, you will not receive credit for quizzes. That being said, I will make an effort, but not guarantee, to provide advance warning of quizzes.

Homework: Homework assignments will be conceptual and comprehensive problems that I develop and you will solve completely. These will be challenging and time-consuming. Homework will be scanned and submitted to Blackboard. Sometimes homework grades will be based on effort, while other times it will be based on demonstration of competency. Every homework is subject to the neatness policy outlined above. Late homework will not be accepted.

Term  
Projects:

### **Term Project #1: Explain a Structural Failure with a Physical Model**

In all aspects of life, learning from a failure is critical to progressing. Structural Analysis is no different, though the consequences may be substantial. Throughout history, many structures have failed. Engineering practice has a responsibility to react. As up and coming engineers, you need to learn from history and ensure that mistakes are not repeated. The overarching purpose of this project is to expose you to structural failures, the circumstances that bring them about, the consequences, and the role of the engineer throughout.

You make work alone or in groups up to four, and you may choose your failure. The presentation and the development of the model will be group work. Only six groups, at most, will be allowed to present a particular failure, and it is first come first serve. There are three deliverables to this project

1. Conceptual Design Sketches – Due October 5, 2018 – 33%
2. Physical Model – Due November 27, 2018 – 33%
3. Presentation – Due November 27, 2018 – 33%

Select a structural failure to research. Some suggestions include:

- Kansas City Skyway
- I-35W in Minneapolis
- I-5 Skagit River
- Florida International University Bridge
- Silver Bridge

You can select any failure you like. The above are just suggestions. Throughout the term, you and your group will develop a simple physical model to explain your failure. You do not need to create a replica of the structure. Your goal is to show the mechanism by which the failure occurred. Think outside the box in terms of materials and approach. You are required to meet with Dr. Weidner as a group prior to October 5, 2018 to discuss the conceptual design sketches for your model. Failure to schedule this meeting with Dr. Weidner before the deadline (using [weidner.acuityscheduling.com](http://weidner.acuityscheduling.com)) will result in a 33% reduction in your overall project grade.

You will accompany your model with PowerPoint slides that cover the circumstances that led to the failure that may not be strictly engineering related – like decisions which led to a situation where failure was likely. You should discuss the consequences of the failure, the influence on engineering practice, and the role of the engineer in this failure and in preventing future failures. I also want you to reflect on how building a model did or did not help you better understand the failure. The presentation should be ten minutes or less and will be peer evaluated. I want this to be fun, so surprise us.

Class Presentations will be on November 27<sup>th</sup>/29<sup>th</sup>, 2018. Attendance is mandatory for peer evaluation. Your presentation slides and model will be submitted. The model will be returned to you if you want it. The slides should be presented electronically.

## **Term Project #2: Discuss Sustainable Structural Engineering**

The second term project is individual. You are to write a short paper (less than five pages with images) that presents your understanding of sustainability in structural engineering. I understand that you likely do not have that understanding so this paper is both a research paper and a personal reflection. Sustainable design and practices are a critical aspect of engineering, though much newer than structural analysis itself. There is no chapter on sustainable practices in your textbook because there are no definitive instructions on how to implement them. This assignment is asking you to research sustainable engineering, and then apply those ideas to structural engineering. Certain aspects are intuitive, like designing projects using locally sourced, sustainable materials. You can discuss that, but I am looking for you to think out of the box a bit. How do our design and construction practices encourage or discourage sustainable choices?

You need to cite at least three sources. Googling is a good start, but you cannot cite Wikipedia. You should be citing scholarly work, or original sources for news articles and other material. If you are struggling to find a topic, please feel free to come talk to Dr. Weidner, or start a conversation on Piazza. Do not wait until the last minute for this project. It will require thought and effort very different from the homework assignments.

This paper must be original work and will be checked electronically for plagiarism. If you are found to have plagiarized, the paper will receive no credit, and Dr. Weidner is obligated by university policy to report the incident to the Office of Student Conduct. Please do not plagiarize. If you have questions about plagiarism there are plenty of online resources at your disposal, or you may come speak with Dr. Weidner.

The paper is due on November 6, 2018 in electronic form by 9AM. Papers that are submitted late will lose 20% immediately and an additional 20% for each additional day.