CE 5318: Bridge Engineering
Department of Civil Engineering

General Information

Instructor:	Jeff Weidner, Ph.D. Office: Engineering Annex A-222 Labs: Engineering E-214	IDRB 3.101 Office Phone: (915)-747-6913 Email: jweidner@utep.edu Office Hours: By appointment – www.jeffreyweidner.com/schedule
Meeting Time and Location:	Tuesday/Thursday 3:00PM to 4:20PM UGLC 340
Final Exam:	None
Course Description:	From the university course catalog: General considerations for design and load capacity evaluation of highway bridges. Introduction to load and resistance factor design (LRFD) philosophy. Bridge loads. Influence lines. Grillage analysis of bridges. Reinforced and prestressed concrete bridges. Composite steel bridges. Bridge substructures. Load rating. Introduction to seismic analysis and design. My description: A broad approach to bridge engineering encompassing the full lifecycle of a structure. This course will cover the analysis, design, evaluation, management, maintenance, and preservation of bridges. The focus of the course will be standard, steel multi-girder bridges but other bridge types will be discussed. Hand analysis approaches as well as software analysis will be covered. The primary reference will be the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specification, 2010 (5th Edition).
Class Approach:	Course Blocks: The course will be split into five blocks of roughly 3 weeks each. In each five-week block, you will have at most one block project and at least one homework due. In total, there are five block projects planned. Communication: I will utilize Blackboard as a file repository for the class. I will also post grades on Blackboard. I plan to set up a Microsoft Teams group to support online communication. Lectures: I plan to give lectures in several formats including traditional PowerPoint presentations, chalkboard lectures, iPad lectures, and interactive discussions. I will make lecture resources available via Blackboard as I see fit.

Much of the course material was developed by Matthew Yarnold, Ph.D. P.E., a professor at Texas A&M and is being adapted with his permission.

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: R.M. Barker and J.A. Puckett, Design of Highway Bridges (3rd Edition)
Note that this book is available electronically through the UTEP Library system ***I am working to get access to the fourth edition which is updated substantially, but it will not happen until after Sept. 1st, 2021 at the earliest.

Course Objectives: By the end of this course you should:
1. Understand the lifecycle of a bridge and the role of engineers in the analysis, design, evaluation, management, maintenance, and preservation of bridges
2. Be proficient at identifying bridge type and components and describing bridges in technical vernacular
3. Have a strong understanding of design theory for bridges
4. Have a strong understanding of load rating approaches
5. Understand and be able to calculate demands on a bridge
6. Be able to conduct simple analyses of bridges, where appropriate, without the aid of software
7. Be able to conduct complex analyses, where appropriate, with the aid of software.
8. Be able to design Steel and Concrete Superstructure Elements
9. Be able to navigate the AASHTO LRFD Bridge Design Specification
10. Be aware of issues with curved bridges, skewed bridges, fatigue and fracture, fit up, temperature loading, and other higher-level considerations.
11. Understand the process of bridge management, including inspection and evaluation, rating and posting, maintenance practice and challenges, bridge preservation, and challenges with replacement

Course Material (Subject to Change):

Date	#	Topic
23-Aug	1	Introduction to Bridge Engineering
25-Aug	2	Introduction to Bridge Engineering Continued
30-Aug	3	Design Considerations
1-Sep	4	Design Methodologies
6-Sep	5	No Class - Labor Day
8-Sep	6	Review of Probabilistic Design
13-Sep	7	Simple Examples on Design Methodologies
15-Sep	8	Load Formulation
20-Sep	9	Influence Lines
22-Sep	10	Lateral Load Distributions
27-Sep	11	Design 1
29-Sep	12	Design 2
4-Oct	13	Accelerated Bridge Construction
6-Oct	14	Structural Analysis Review
11-Oct	15	Structural Analysis

13-Oct	16	RC Deck Design
18-Oct	17	Geometry and Other Concerns
20-Oct	18	Pedestrian Bridges
25-Oct	19	Design of Other Bridge Components
27-Oct	20	Load Rating Formulation
1-Nov	21	Load Rating Application
3-Nov	22	Bridge Management and Inspection
8-Nov	23	Inspection Activity
10-Nov	24	Introduction to Nondestructive Evaluation
15-Nov	25	Structural Testing and Monitoring
17-Nov	26	Famous Failures
22-Nov	27	Historic Construction Methods
24-Nov	28	Thanksgiving
29-Nov	29	Historic Preservation
1-Dec	30	Closeout

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. See the class approach for information about online resources. Student athletes should speak with me at the start of the term to work out a plan for expected absences.
COVID-19	Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, let us know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, we strongly encourage you to report your results to covidaction@utep.edu. This will mobilize University resources to both support you and help with communication with your professors as well as initiate contract tracing through Environmental Health Services on campus. This helps to keep everyone safe. Students have access to COVID-19 testing at the Student Health Center.
	The Center for Disease Control and Prevention recommends that people in areas of substantial or high community transmission of COVID-19 wear face masks when indoors in groups of people, irrespective of vaccination status. To that end, we also STRONGLY ENCOURAGE you to wear masks in class. The best way to protect yourself, your classmates, and your community is to get vaccinated
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. I accept both handwritten and digital homework. Handwritten homework can be completed using pen and paper, or on an iPad. Handwritten homework can be submitted electronically. Digital homework applies to solutions which make use of Microsoft Excel, MathCAD or MatLab. All homework will be submitted electronically through Blackboard.

For handwritten homework:
- Complete homework assignments on engineering paper (available in the bookstore or on Amazon). **Loose-leaf paper is not permitted.** Any work submitted on paper that is not engineering paper will be deducted 25%.
- 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)

For digital homework:
- 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 using an appropriate software tool.
- Box, underline or highlight answers so they can be readily identified.
- List any external references used in the homework (i.e., textbook tables)
- Be sure to comment and explain actions and calculations that are not immediately interpretable. Do this liberally.
- For software like Microsoft Excel, be sure that each calculation is commented and explained.

All electronic submissions (Handwritten or digital) should follow these conventions:
- Preferred format is PDF, with original files for MathCAD, MatLab, Excel or any FE software attached as well.
- Filename should follow this format: LastnameFirstInitial_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.
Software:	UTEP provides access to several software packages for structural analysis if you elect to use them.

Coursework and Grading Expectations

Grading: Grade Breakdown:

Exams:	10% for Mid-term
Project 1:	10%
Project 2:	10%
Project 3:	20%
Project 4:	20%
Project 5:	20%
Homework:	10%

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. 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.
Extended exams (longer than the allotted class period) are only provided through the Center for Accommodations and Support Services. This includes exceptions that result from acute events that occur throughout the term.

Homework: The homework assignments will be conceptual and comprehensive problems that you will solve completely and I will grade. These will be challenging and time-consuming. Your work must adhere to the neatness policy provided above. Work must be done on an individual basis, within the confines of the group work policy.

Block Project #1: Trade Article Review

Due Date: End of Block #1 – September 13, 2021
Project Description: Review an article from a trade magazine describing a bridge construction, rehabilitation, retrofit or replacement project and extract from the article the primary design challenges and how they were addressed. From that, you are to develop a short document providing a review of the article with discussion on the design challenges and how they were addressed. You are only required to use the one source provided, but you are free to do additional research if desired. You will be graded on your ability to construct a cohesive picture of the project and the design challenges.
Submission: You will submit a short (less than 5 pages) document in PDF format electronically.

Block Project #2: Journal Article Review	**Due Date:** End of Block #2 – October 4, 2021 **Project Description:** For this project, you are to identify a journal paper focused on bridges. You will read the paper, ingest it and produce your own summary. You should not simply parrot back what the author says. Provide your take on the research, the approach, and the benefits. You will produce a short presentation on the paper, and a one-page written summary. Do not review a paper written by Dr. Weidner. Good journals to consider that are available from the UTEP Library: - ASCE Journal of Bridge Engineering - ASCE Journal of Structural Engineering - ASCE Journal of the Performance of Constructed systems - Engineering Structures - Frontiers: Bridge Engineering (Open Access) **Submission:** You will present a brief overview of the paper to the class explaining the hypothesis, the research approach proposed, the implementation of the project, the results, and the effects of those results on practice. When you present you will also submit a one-page written summary of the journal paper.
Block Project #3: Analysis of a Truss Bridge	**Due Date:** End of Block #3 – October 25, 2021 **Project Description:** Analyze a truss structure using matrix structural analysis methods and MatLab. I will provide you with a base code in MatLab which you will edit to analyze the truss for a set of load cases. **Submission:** You will submit the code that you modify in text format, along with a short report summarizing your results. The report should be easy to read and understand, with clear naming and numbering conventions shown, assumptions stated, and tabulated results.
Block Project #4: Assessment of Load Capacity of an In-Service Bridge	**Due Date:** End of Block #4: - November 15, 2021 **Project Description:** Conduct a load capacity assessment of an in-service multigirder steel bridge. You will be provided a set of plans and some inspection data for a structure. From there you will assess the capacity of the structure to carry traffic via a load rating analysis. You will use structural analysis software to help solve this challenge. **Submission:** You will submit a short report detailing your analysis approach and results. The report should be easy to read and understand, with clear naming and numbering conventions shown, assumptions stated, and tabulated results.
Block Project #4: Bridge Design	**Due Date:** End of Block #5 – December 1, 2021 **Project Description:** Design a *safe and efficient* steel rolled beam alternative for a simple span bridge. The design requirements will be provided separately. Each member of the team is responsible for one design alternative. Additionally, each member of the team is responsible for checking the design calculations of the other team member. The marked-up calculations must be kept and included in the report appendices. Both team members are responsible for all design calculations and the report. ***Note that this is block project is worth 20% of your final grade.*** **Submission:** Each team of two will submit one report. The report will include cover page, a write-up explaining the design process, the final design results, and

appendices with marked-up and final calculations for both alternatives. These calculations must be well organized with clear indicators of what the calculations is doing, who was the designer, and who was checking.