CE 5323: Prestressed Concrete
Department of Civil Engineering

General Information

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Meeting Time and Location: Tuesday/Thursday: 3:00 PM to 4:20PM
CCSB 1.0204

Final Exam: Thursday December 8, 2022 from 4:00PM - 6:45PM

Course Description: From the university course catalog:

> Theory, advantages, and limitations; various systems of prestressing; composite construction; continuous span theory.

My description:

> Theoretical and practical exploration of prestress concrete analysis and design, primarily focusing on flexural demand for bridge applications

Class Approach: This course introduces the concept of prestressed concrete. It will build directly off what you learned in Reinforced Concrete Design. Note that the typical practicing structural engineer does not necessarily use these methods on daily basis as much of structural design is either tabulated or comes from software. However, I believe it is critical for young engineers to learn concepts and approaches. I am not alone in this sentiment. William Baker, the engineer behind the Burj Khalifa said the following, when asked about structural engineering education:

> *"I would put more emphasis on the theory of structures, engineering mechanics, and the behavior of materials: the true technology of our discipline. These are things that will not change unless you invent new materials. A building code has the shelf life of a banana: it's going to change and it's going to morph into something different. However, the underlying physics will stay the same. What is the use of the future structural engineer? If you go back a long time, you had to understand theory because you could not calculate very much. Today, we're in a computational age where we use a tremendous amount of brain power to manipulate the "box". In the future, computation*

will be so trivial, where it almost becomes unimportant, but the theory will be the paramount thing that the engineer will bring to design.

Textbook:

Required:

Nawy, E. G., "Prestressed Concrete: A Fundamental Approach" 5th Edition with updates (2010)

Referenced:

Nilson, A., "Design of Prestressed Concrete" 2nd Edition (1987)

Naaman, A. "Prestressed Concrete Analysis and Design Fundamentals" 3rd Edition (2012)

Walraven, J.C. and Braam, C.R., "Voorgespannen Beton" 2nd Edition – English Translation (2015)

Hassoun, M.N. and Al-Manaseer, A., "Structural Concrete: Theory and Design" 7th Edition (2020)

Course Objectives:

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

1. Explain the concept, method, materials, advantages, and limitations of prestressed concrete
2. Analyze the state of stress in a prestressed concrete beam at any time
3. Calculate the strength of prestressed concrete beams
4. Design prestressed concrete beams
5. Explain practical applications of prestressed construction in bridges and buildings

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.

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 ask that you do the following:

- Complete homework assignments on engineering paper (available in the bookstore or on Amazon) or in a digital fashion. **Loose-leaf paper is not permitted.** Any work submitted on paper that is not engineering paper will be deducted 25%.
- Use sharp pencils/pens 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

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:

We will be developing software tools throughout the term to conduct structural analysis and design of prestressed concrete beams. I am not a prolific coder, and neither are you (most likely). The goal is to gain exposure and to push ourselves to learn and apply new skills.

When you need to use software, it will be clearly assigned. You can feel free to check your solutions with 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:

Exams:	20% for Mid-term 1
	20% for Mid-term 2
	20% for Final Exam
Homework:	40%

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.

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.

Homework: Homework will be assigned on Tuesdays and will be due the following Tuesday. There are a total of ten homework assignments. They should be complete and submitted online through Blackboard prior to the start of class. There will be no extensions given.

Course Schedule

Week	Lecture	Date	Subject	Lecture Details	Assignments
1	1	23-Aug	First Day Activity	Hands on PS Concept	None
	2	25-Aug	Syllabus/Course Overview/History	None	None
2	3	30-Aug	Basics I	Basic Concepts	HW1
	4	1-Sep	Basics II	Review topics	None
3	5	6-Sep	Basic III	Materials	HW1 Due; HW2
	6	8-Sep	Basics IV	Prestress losses - Theory	None
4	7	13-Sep	Basics V	Prestress losses - Examples	HW2 Due; HW 3
	8	15-Sep	Analysis I	Direct Computation of Stress	None
5	9	20-Sep	Analysis II	C-Line Method	HW3 Due; HW4
	10	22-Sep	Analysis III	Load Balance Method	None
6	11	27-Sep	Exam #1 Review	Section Analysis and PS Loss Calculation	HW4 Due
	12	29-Sep	Exam #1		None
7	13	4-Oct	Design Basics	ASD; LRFD; What we design for in PS	HW5
	14	6-Oct	Design I	Load-Def Behavior of PS Beams	None
8	15	11-Oct	Design II	Initial Section Modulus Selection	HW5 Due; HW6
	16	13-Oct	Design III	Service Design of Beams for Flexure	None
9	17	18-Oct	Design IV	Service Design of Beams for Flexure	HW6 Due; HW7
	18	20-Oct	Design V	Ultimate Design of Beams for Flexure	None
10	19	25-Oct	Design VI	Ultimate Design of Beams for Flexure	HW7 Due; HW8
	20	27-Oct	Design VII	Design for Shear	None
11	21	1-Nov	Exam #2 Review	Design Examples	HW8 Due
	22	3-Nov	Exam #2		None
12	23	8-Nov	PS Bridges	TXDOT Design - Guest Lecture w/ Liz Montes from Consor	HW9
	24	10-Nov	PS Bridges	TXDOT Design examples with tools	None
13	25	15-Nov	PS Buildings (PT)	Guest Lecture with TBD	HW9 Due; HW10
	26	17-Nov	PS Buildings (PT)	Guest Lecture with Javier Carlin	None
14	27	22-Nov	Float	Lecturesgiving?	HW10 Due
	28	24-Nov	Thanksgiving		
15	29	29-Nov	Float	TBD	Project Due
	30	1-Dec	Exam #3 Review	Comprehensive	None
16	31	8-Dec	Final Exam		None