Instructor: Arancha Alarcon, PhD, PE, LEED AP, (arancha.alarconfleming@northwestern.edu), Tech A220

Office hours: By appointment at A220 or https://northwestern.zoom.us/j/5311890730

Class times: 12.30-1.50 PM Monday and Wednesday

Required Textbook None

Reference Textbooks

2. Design of Prestressed Concrete Structures, T.Y. Lin and Ned Burns
3. Creep and Shrinkage: Their effect on the behavior of concrete structures" by H. Rusch, D. Junwirth and H. Hilsdorf
4. Philosophy of Structures by E. Torroja

Prerequisites: Graduate standing, Senior undergraduate or permission of instructor


Course Objective: The objective of this course is to introduce graduate and senior undergraduate students to theory and applications of prestressed concrete. Students will build on the knowledge gained through all mechanics related courses of the undergraduate curriculum (statics, mechanics of materials, concrete design, etc.).

Course Outcomes: Upon successful completion of the course, students will have an advanced understanding of the behavior of prestressed concrete structures as well as knowledge of design specifications currently used in practice. In addition, students will have the necessary skills to analyze and design prestressed concrete structures and will be able to:

1. Describe typical prestressing systems.
2. Describe the mechanical behavior of typical concrete and steel used in prestressed concrete construction.
3. Calculate prestress losses.
4. Analyze and design prestressed concrete members in bending under service loads.
5. Analyze and design prestressed concrete members in bending under ultimate loads.
6. Compute shear and torsional strength of prestressed concrete members.
7. Solve statically indeterminate prestressed concrete structures.
8. Compute camber and deflection of prestressed concrete members.

Algeciras Market (Spain) by Eduardo Torroja (1936)

Tempul aqueduct (Cadiz, Spain) by Eduardo Torroja (1925)
Course Outline

1. Introduction to prestressing, equivalent loads to prestressing
2. Material properties of Concrete and Steel
3. Rheological Equations. Mechanical Models
4. Axially Loaded Members
5. Prestress Losses
6. Brief approach of Matrix Structural Analysis (Direct Method) of Statically Indeterminate prestressed beams
7. Design of Sections for Flexure (Service and Ultimate)
8. Design of Sections for Shear
9. Strut and Tie Method

Course Assessment: Grades are determined based on the following components

- 20% Homework
- 30% Final Project (Due December 8, 2021)
- 10% Project presentation
- 30% Midterm (Wed. Oct 20, 2021 in class)
- 10% Participation

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