

Civil Engineering 574: Design of Prestressed Concrete Structures

Course Description: 3 cr. U/G. Design of prestressed concrete structures; methods of prestressing, loss of prestress; design for flexure, shear, torsion; camber and deflections; continuity; connections; fire rating; circular prestressing. Prereq: Jr St, Civ Eng 360(P), 372(P)

Textbooks:

- Edward G. Nowy, *Prestressed Concrete Design*, 2000
- *PCI Design Handbook*, latest edition (1997)

Prerequisites by Topics:

- Introductory Structural Analysis
 - Determination of forces and deflections
 - Pattern loading; influence lines
 - Compatibility and superposition to solve statically indeterminate structures
- Introductory Reinforced Concrete Design
 - Material properties
 - Codes and safety
 - Transformed section properties
 - Design of one-way flexible members; short columns and isolated footings

Course Objectives:

Broad Objectives

- Develop professional level competence in the design of commonly used prestressed concrete structures

Learning Outcomes

- Students have the ability to:
 - recognize the importance of public safety in design.
 - recognize the role of government agencies and code bodies in the design process.
 - gather and sort design input.
 - make reasonable assumptions and test those against fundamental knowledge.
 - conceive design alternatives.
 - carryout design of commonly used prestressed concrete systems using fundamental principles as well as design aids.

Topics Covered:

- Background
- Design Criteria (ACI 318 and PCI)
- Distinctions Between Cast-in-place, Precast, Pretensioned and Post-tensioned Concrete
- Various Structural Systems
- Lateral Load Resistance/Shear Walls
- Flexure, Shear and Torsion Design of Standard Precast/prestressed Products

- Connection Design and Details
- Camber and Deflection
- Volume Change Effect
- Continuity in Precast/prestressed

Projects/Extended Problems

- A variety of independent projects. Students form teams of about three (solo for graduate students) and carry out an independent study, write a report and make a presentation at the semester's end.

Written Communications

- Report writing on selected independent study project

Oral Communications

- Report presentation on the independent study project

Class/Laboratory Schedule: Two 75-minute lectures per week.

Contribution of Course to Meeting the Professional Component:

Use of engineering codes and standards (primarily ACE318), PCI. Design of Project: The students are given an open-ended design project as compared to guided design calculations in typical homework assignments. Preliminary design and final design are expected. An effort of 40 hours is estimated. Independent Study and Report Development: The students either propose a topic of study or pick from a list provided by the instructor. A study of the background, analysis of the state of the art and recommendations for further development are expected. The students work in teams of 2 or 3 (solo for graduate students) and develop a report and make a short presentation at the end of the semester.

Relationship to Program Objectives:

- 1c Students apply algebra, elementary calculus, and principles of mechanics.
- 1d Students examine project requirements, sort out appropriate constraints and carry out solutions.
- 2a Students use latest codes, design manual and computer techniques for solutions.
- 2d Students design components and their interaction with structural system.
- 2e Students write report and make presentation.
- 2f Students develop a critical ability to address advanced design situations because the course stresses fundamental principles behind code provisions.
- 2g Students use primary material and standards codes which are referenced or included in legal documents and model codes.
- 4c By focusing on the limitations of current practice and the changing technology, students recognize the need for technical updating on a continuing basis.

Prepared by: A. Fattah Shaikh, September 12, 2001

Methods of Assessment:

- Course Evaluations by Students
- Graded Assignments
- Graded Examinations
- Graded Independent/Term Projects Reports and Presentations
- PE Exam
- Industry Advisory Council Review

Resources Commonly Available:

- Instructor
- Library
- Computer Facilities

Desirable Student Competencies:

- Report writing skills
- Presentation skills