



**Jordan University of Science and Technology**  
**Faculty of Engineering**  
**Civil Engineering Department**

**CE 532 Prestressed Concrete**

**2007 Course Catalog**

3 Credit hours (3 h lectures). Basic principles, short- and long-term properties of constituent materials, partial prestressing. Flexural behavior, analysis and design of prestressed concrete beams, classes, cracking, pretensioning, post-tensioning, service load design, load balancing, strength design, strain limits, flexural efficiency. Bond, transfer and development lengths, anchorage zone design. Shear and diagonal tension. Evaluation of immediate and long-term losses. Composite construction and design, shear-friction theory. Deflection calculation using approximate single time step approach.

**Textbooks**

Nilson, Arthur, H., Design of Prestressed Concrete, John Wiley and Sons.

**References**

**Books**

- 1) Nawy, E. G., Prestressed Concrete A Fundamental Approach, Prentice Hall.
- 2) PCI Design Handbook, Prestressed/Precast Concrete Institute.
- 3) Building Code Requirements for Structural Concrete and Commentary (ACI 318M-08).
- 4) Lin, T. Y., Design of Prestressed Concrete Structures, John Wiley and Sons.
- 5) Naaman, A. E., Prestressed Concrete Analysis and Design – Fundamentals, McGraw Hill Book Company.

**Prerequisites**

**Prerequisites by topic**      Stress strain relations, Analysis of determinate and indeterminate structures, Properties of Concrete and Steel, Design of reinforced concrete beams for flexure and shear.

**Prerequisites by course**      CE 432

**Co-requisites by course**      CE 531

**Prerequisite for**      -

**Topics Covered**

<b>Week</b>	<b>Topics</b>	<b>Chs. in Text</b>
1-2	Basic Concepts; Definitions, Equivalent Loads, Partial Prestressing, Stressing Methods, Losses, Serviceability, Strength.	Ch. 1
3	Materials; Types, Importance of Using High Strength Steel, Stress - Strain Properties of Steel and Concrete, Long -Term Properties.	Ch. 2
4-6	Flexural Analysis; Flexural Stresses Before and after Cracking, Allowable Stresses, Cracking Load, Flexural Strength, Partial Prestressing,.	Ch. 3
7-10	Flexural Design; Stress Basis, Shape Selection, Load Balancing, Unified Strength Design, Bond and Transfer Length, Anchorage Zone Design, Crack Control.	Ch. 4
11-12	Shear Design; Diagonal Tension and Cracking, Web Reinforcement.	Ch. 5
13	Losses of Prestress Force, Lump Sum Estimate, Detailed Estimation	Ch. 6

	of Losses, Short-Term and Long-Term Losses.	
14-15	Composite Beams; Load Stages, Sectional Properties and Flexural Stresses, Flexural Strength, Horizontal Shear Transfer, Shear Friction Theory.	Ch. 7
16	Deflection of Prestressed Concrete Beams.	Ch. 9

### Evaluation

Assessment Tool	Expected Due Date	Weight
Homework & Quizzes	One week after homework problems are assigned	10%
First Exam	According to the department schedule	25 %
Second Exam	According to the department schedule	25 %
Final Exam	According to the University final examination schedule	40 %

### Objectives and PIs

Course Objectives	Performance Indicators
<b>CO-1:</b> Develop firm basic understanding of the fundamental principles of prestressed concrete behavior, and prestressing capabilities.	(e)PI_1: Students are able to identify engineering problems (f)PI_1: Students are able to recognize professional responsibility
<b>CO-2:</b> Able to handle with confidence complete design of prestressed concrete elements using various approaches.	(c)PI_1: Students are able to design a component to meet certain constraints
<b>CO-3:</b> Use computer software for the analysis and design of prestressed concrete Structures.	(k)PI_2: Students are able to use modern engineering tools for engineering practice
<b>CO-4:</b> Develop engineering judgment to design safe and efficient prestressed concrete structures.	(d)PI_2: Students are able to formulate a collective solution to a problem

### Contribution of Course to Meeting the Professional Component

The main objective of this course is to provide students with the necessary fundamental background to understand the structural behavior, analysis and design of prestressed concrete structures subjected to variety of loading conditions. Prestressed concrete is essentially reinforced concrete in which steel reinforcement is tensioned against the concrete, thereby introducing compression in concrete and hence overcoming the tensile weakness of concrete relative to its compressive strength. The emphasis is concepts and methods used in designing prestressed concrete structural elements and systems.

### Relationship to Program Outcomes (%)

A	B	C	D	E	F	G	H	I	J	K	L
5		60	5	10	10					10	

### Relationship to Civil Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4
√	√	√	√