Course Objective
The course provides a solid background on the principals of prestressed concrete design. The main goal of the course is that students will understand the differences of reinforced concrete and prestressed concrete structures and perform the analysis and design of various prestressed concrete elements to reach the most economical design. The students will perform structural analysis models using SAP2000 and compare the results with hand calculations so that they will gain confidence in the software modeling of prestressed concrete structures and the hand calculations. Additionally, students will learn advances in the field of the prestressed concrete through reading and summarizing articles from the PCI Journal.

Textbook (suggested) and Manual
Nawy, Edward “Prestressed Concrete: A Fundamental Approach” (5th Edition)
PCI design handbook of “Precast and Prestressed Concrete” (7th Edition)
ACI381-08 Building Code Requirement for Structural Concrete

Computer Usage
SAP2000 structural analysis software for design of structural systems, Excel or Matlab

Term Project
Each student will select an article from a peer-reviewed journal (e.g. Engineering Structures, ACI Structural Journal, PCI Journal) related to the topics discussed in this course and published within last fifteen years. The selected articles will be sent to the instructor by November 1, 2010 for the approval. The summary of the article will be prepared and submitted by December 2, 2010. The final report will
include the detailed summary of the article. Sentences and sections directly copied from the article will not be accepted. The final reports that prove the results of the article analytically or numerically will have extra credits.

**Grading Criteria**
Homework: 15% (solutions will be provided a week after due date; late homework within a week will get 70% of total grade; no homework will be accepted a week after the due date)
Midterm Exam I: 20% (Including chapters 1, 2, 3 and 4)
Midterm Exam II: 20% (Including chapters 5, 6 and 7)
Term Project: 15%
Final Exam: 30% (Including all chapters discussed in the lectures)

**Grading System**
Score≥90 → A
75≤Score<90 → B
60≤Score<75 → C
45≤Score<60 → D
<45 → F
Mid-term grades will be provided after the second mid-term examination.
No make-up exams unless a doctor report is provided.

**Topics of Study**
1. **Basic Concepts**
   a) Introduction
   b) Methods of prestressing
   c) Prestressing methods
   d) Internal equilibrium
   e) Forces exerted by tendons
2. **Materials Properties**
   a) Steel
   b) Concrete
3. **Prestress Losses**
   a) Theory
   b) Examples
4. **Flexural Analysis**
   a) Load stages
   b) Elastic flexural stresses in uncracked beams
   c) Allowable stresses
   d) Cracking load
   e) Flexural strength analysis
   f) Contribution of non-prestressed reinforcement
5. **Flexural Design**
   a) Flexural design based on allowable stresses
   b) Shape selection
   c) Concrete protection
   d) Anchorage zone design
6. **Shear and Torsional Design**
a) Shear and diagonal tension in uncracked beams  
b) Diagonal cracking shear  
c) Web reinforcement for shear  
d) Shear design by the ACI code  
e) Torsion design by the ACI code  
f) Combined shear and torsion  

7. Axially Loaded Members  
   a) Compression members  
   b) Tension members  

8. Deflections  
   a) Short-term (instantaneous) deflection of uncracked and cracked members  
   b) Long-term effects on deflection  

9. Connections for Prestressed Concrete Structures  
   a) Draped-end beam connections  
   b) Typical connection details