CE 535: Prestressed Concrete Structures

Course Description:
Design of prestressed concrete structures, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, and statically indeterminate structures.

Course Outcomes (students should be able to):
1. Formulate and explain the principles of prestressed concrete design.
2. Describe pretensioning and post-tensioning systems and estimate the corresponding losses.
3. Analyze and design prestressed concrete components according to the appropriate codes.

Course Topics
- Introduction
  - Description of Prestressed Concrete
  - History, Applications, Benefits
  - Types of Prestressed Concrete & Basic Concepts
- Material Properties
  - Concrete, Prestressing Strand
- Prestressing System
  - Pretensioned, Post-tensioned
- Prestress Losses
  - Elastic Shortening, Relaxation, Friction
  - Anchorage Setting, Creep, Shrinkage
- Analysis and Design for Flexure
  - Flexural Behavior, Allowable Stresses
  - Optimum Design – Magnel Diagram
  - Tendon Layout
  - Nominal Moment – Bonded and Unbonded
- Analysis and Design for Shear
  - Shear Behavior, Influence of Tendon Force, Shear Reinforcement
- Indeterminate Structures
  - Secondary Moments
  - Concordant Tendon Path
  - Linear Transformation
  - Compatible Tendon Profile
- Development and Anchorage Zone
  - B- and D-Regions
  - Strut-and-Tie Method
  - Anchorage Zone Design
- Camber and Deflection
  - Initial Camber and Deflection
  - Long-Term Camber and Deflection