

## **CES 6706 Advanced Reinforced Concrete**

This course is aimed at addressing the behavior of reinforced concrete (RC) structures beyond what is typically taught in reinforced concrete design courses. It will address as many of the following topics, as time permits (some changes might be expected, depending on students' research interests/activities):

1. Introduction and philosophy for structural systems behavior and performance.

2. Available technical resources (ACI, ASCE, FEMA, GSA, DOD).

3. Loading sources (e.g., static, seismic, wind, blast, impact, etc.), and load characterization.

4. Material behavior for RC structures:

- Uniaxial stress-strain curves for steel and concrete
- Confinement effects (biaxial, and triaxial behaviors)
- Time-dependent behaviors
- Size effects

5. Axial and flexural behavior of structural elements:

- Short columns
- Beams
- Slabs, including tensile and compressive membranes
- Shear walls

This will include approaches for derivation of moment-curvature and load-displacement relationships (including a fiber approach), hinge formation, damage and response limits.

6. Shear effects:

- Diagonal shear behavior
- Truss analogy and strut-and-tie models
- Moment-shear interaction ( $M - a/d - \rho$  relationship)
- Direct shear

7. Connections

- Behavior and Mechanics
- B and D regions
- Struct-and-tie approaches
- Applications to L, T, and X connections

8. Introduction to frame behavior and progressive collapse.

9. Expedient analysis to support assessment and design.

10. Case histories.