



## CE 417 – Advanced Concrete Materials

**Code and Name:** CE 417 – Advanced concrete materials

**Credit Hours:** 3 (Lecture: 3, Tutorial: 1)

**Textbook:**

- Zongjin Li, Advanced concrete technology, 3rd Edition, John Wiley and sons, 2011

**Other References:**

- <http://www.concrete.org/>

**Course Description:**

Rheology models for concrete, microstructure and strength relationships, failure modes, fracture mechanics, creep, shrinkage and thermal deformations, design for durability and performance, quality control and quality assurance for concrete materials, fiber-reinforced concrete.

**Pre-requisites:** CE310 - Concrete Properties

**Co-requisites:** None

**Course Learning Outcomes:**

With relation to ABET Student Outcomes (From Fall 2019-SOs: 1-7)

1. Understand advanced concepts of concrete fracture (1)
2. Evaluate thermal, shrinkage and creep deformations (1)
3. Compare the knowledge of rheological properties of high and normal strength concrete (1)
4. Predict special situations of concrete like concrete under fire, hot and cold weather concrete (1)
5. Analyze the advanced Cementitious Composites, Fiber Reinforced Composites (1)
6. Recognize the different types of special concrete: High Strength Composites, Shrinkage Compensating Concrete, Self-Compacting Concrete, Tube reinforced Concrete and Fly-ash Concrete (1)
7. Interpret and analyze the data of the nondestructive tests on different types of concrete (6)

**Topics to be covered:**

- Introduction to advanced concrete materials, Rheology models for concrete
- Microstructure of concrete
- Strength of hardened concrete, Constitutive models for concrete
- Thermal, Shrinkage and Creep deformations
- Design for durability and performance
- Concrete fracture mechanics, linear and nonlinear fracture mechanics in concrete
- Advanced cementitious composites, Fiber reinforced composites
- High strength composites, Shrinkage compensating concrete, Self-compacting concrete, Tube reinforced concrete and Fly-ash concrete
- Nondestructive testing of concrete engineering
- The future and the development trends of concrete

**Grading Policy:**

The grading for the course are 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes for the remaining 20%.

