

Tennessee Technological University  
Department of Civil & Environmental Engineering  
CEE 6300 – Multi-Scale Analysis of Concrete

2017 Catalog Data: CEE 6300  
Lec. 3. Cr. 3.  
Manufacturing, hydration, and microstructural development of Portland cement. Fresh and hardened concrete properties. Special concrete applications, including fiber-reinforced, high performance, and lightweight concretes.

Required Textbook: None

*Recommended Text:* S. Mindess, J.F. Young, D. Darwin, Concrete, Prentice-Hall, 2<sup>nd</sup> Edition, 2003.  
Design and Control of Concrete Mixtures, Portland Cement Association, 14<sup>th</sup> Edition, 2002.  
P.K. Mehta, P. Monteiro, Concrete: Microstructure, Properties and Materials, McGraw-Hill, 3<sup>rd</sup> Edition, 2006.

Faculty Coordinator: Dr. Ben Mohr

Prerequisites: CEE 3030

Goal: To present students with a comprehensive overview of basic principles relating to portland cement and concrete including microstructural development during hydration, mineral and chemical admixtures, fresh and hardened properties, durability, and special applications for concrete.

Course learning objectives:

1. To present students with a comprehensive overview of basic principles relating to portland cement and concrete including microstructural development during hydration, mineral and chemical admixtures, fresh and hardened properties, durability, and special applications for concrete.
2. To improve critical assessment.
3. To improve written and oral technical communication skills.
4. To integrate research and learning.

Major Topics Covered:

1. Cement Manufacturing
2. Portland Cement Specifications
3. Cement Hydration
4. Specialty and Non-Portland-Based Cements
5. Supplementary Cementitious Materials
6. Fresh and Hardened Concrete
7. Durability
8. Specialty Concretes – FRC, HPC, LWC

Measurable outcomes:

Students will be expected to:

1. Understand the difference between prescriptive and performance based specifications.
2. Understand the evolution of hydrated cement paste microstructure and its role in the development of setting and strength development.
3. Understand mix proportioning and influence of components on fresh and hardened properties.
4. Understand basic durability concepts.