

Department: Civil Engineering
Number: CE 5355
Title: Advanced Civil Engineering Materials

Catalog Description: Advanced topics in civil engineering materials, design and characterization of asphalt cement and asphalt concrete mixtures, design and characterization of Portland cement concrete, and application of composite materials to Civil Engineering Projects

Prerequisites: CE 3336 and Permission of instructor

Textbook:

1. *Hot Mix Asphalt Materials, Mixture Design, and Construction*, (second edition) by F.L. Roberts, P.S. Kandhal, E.R. Brown, D.Y. Lee, and T.W. Kennedy; NAPA Research and Education Foundation, 5100 Forbes Blvd., Lanham, Maryland 20706-4413. Phone: 301-731-4748, 2nd ed., 1996.
2. *Background of SUPERPAVE Asphalt Binder Test Methods*, R.B. McGennis, S. Shuler, H.U. Bahia, Asphalt Institute, Lexington Kentucky, 1994.
3. *Background of SUPERPAVE Asphalt Mixture Design and Analysis*, R.B. McGennis, R.M. Anderson, T.W. Kennedy, M. Solaimanian, Asphalt Institute, Kentucky, 1995.
4. *Design and Control of Concrete Mixtures*, S.H. Kosmatka and W.C. Panarese, 13th ed., Portland Cement Association, Skokie, Illinois, 1988.
5. *Teaching the Materials Science, Engineering, and Field Aspects of Concrete*, Seventh Annual ACBM/PCA Undergraduate Faculty Enhancement Workshop, Purdue University, 2000.
6. *Highway Materials, Soils and Concretes (Third Edition)* by Harold N. Atkins, Prentice Hall
7. *Fundamentals of high-performance concrete 2nd edition*, by Edward G. Nawy, John Wiley, c2001
8. *High Performance Concrete: Properties and Applications*, edited by SP Shah and SH Ahmad, McGraw Hill
9. *Polymer Viscoelasticity Stress and Strain in Practice*, E. Riande, R Diaz-Calleja, MG Prolongo, RM Masegosa, and C Salom, Marcel Dekker, Inc.

Course Objectives: The objective of this course is to familiarize students with the asphalt concrete, and Portland cement concrete and some polymers used in the highway infrastructure. The course is divided in four sections. In the first section, the classical methods plus newly developed methods used for asphalt concrete will be discussed. In the second section, students will be exposed to Portland cement concrete and high performance concrete. In the third section, students will be exposed to the base materials used in the highway infrastructure. In the last section, polymers and plastics used will be discussed.

Specifically student will develop the following skills (the CE program outcomes addressed by each objective are given in parentheses):

Student will be able to utilize advanced concepts of mathematic science, and engineering tools to perform mix designs and characterize advanced civil engineering materials. (1)

Students will be able to work in teams by performing projects and will be able to write technical report and present their study professionally. (3)

Students will learn the various aspects of material characterization and be able to conduct independent work (4)

Topics covered:

- 1.0 Introduction
- 2.0 Asphalt Cement
- 3.0 Asphalt Concrete Mix Design
- 4.0 Portland Cement
- 5.0 Portland Cement Concrete Mix Design
- 6.0 High Performance Portland cement Concrete
- 7.0 Characterization of Asphalt Concrete Material
- 8.0 Characterization of Portland cement Concrete
- 9.0 Composite Material

Class/Laboratory Schedule

Class: MW 4:30 to 5:50 PM

Contribution of course to meeting the professional component: The course contributes towards one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the civil engineering field.

Prepared by: Dr. Vivek Tandon

Date: May 11, 2005