

CE 641 - Civil Engineering Materials I
Fall Semester 1998

1998-2000 Catalog Des.: CE 641: Civil Engineering Materials I. Credit 3. Properties and behavior of structural metals, timber, portland cement concrete, and bituminous concrete; standard specifications and methods of test; inspection and control; long-term protection and durability. Two hours rec. and three hours lab a week. Pr.: CE 534 and ENGL 415. Pr. or conc.: either CE528 or CE 542 or CE 544.

Prerequisites by Topic: Mechanics of Materials Laboratory
Foundation Engineering/Structural Engineering in Concrete/Structural Engineering in Steel
Written Communication for the Engineers

Textbook (s):

1. "Materials for Civil & Highway Engineers", K.N. Derucher et al., 4th Edition, Prentice Hall, 1998.
2. "Handbook for Superpave Volumetric Asphalt Mixture Design", Hossain and Habib, KSU, 1998.

References:

"Design and Control of Concrete Mixtures". 13th edition, Portland Cement Association, 13th edn., 1988.

ASTM Annual Book of Standards, Section 4, Vols. 04.03 and 04.04.

"Hot Mix Asphalt Materials, Mixture Design and Construction"- NAPA Foundation, 2nd edn., 1996.

Standard Specifications for Roads and Bridges, Kansas Department of Transportation, Edition of 1990.

Coordinator: Mustaque Hossain, Associate Professor of Civil Engineering.

Course Learning Objectives:

- i) To study the properties and behavior of widely used materials for civil engineering applications, e.g., Portland cement concrete, bituminous concrete, steel, and timber,
- ii) To expose the students to the standard specifications and methods of test for inspection and control of these materials,
- iii) To design the Portland cement concrete and bituminous mixes, and
- iv) To study the causes of failure and prevention.

At the end of the course the student should be able to:

conduct standard tests and/or interpret test results related to Portland cement, aggregates, Portland cement concrete and bituminous mixes;

design Portland cement concrete and bituminous mixes;

identify the causes of failure of the civil engineering materials like steel, timber, Portland cement concrete and bituminous mixes; and

suggest repairs and/or remedies to prevent failures.

Assessment Methods: Course objectives are assessed through graded performance on several homework assignments and three exams in the recitation section, and graded performance on the laboratory reports and two quizzes in the laboratory section.

Topics:

1. Sources and properties of components of portland cement concrete; hydration of cement; durability issues; designing and controlling adequate mixtures; standard specifications and methods of test, including quality control/quality assurance; advances in concrete technology including fly ash and silica fume concrete. (12 classes)
2. Sources and properties of bituminous concrete components; designing and controlling Superpave bituminous mixtures for paving applications; standard specifications and methods of test. (12 classes)
3. Timber as an engineering material; uses, properties and durability (2 classes).
4. Steel as engineering material; properties, corrosion and prevention of corrosion (1 classes).
5. Plastics (1 class)
6. Geotextiles; properties and uses (1 class)
7. Tests. (3 classes)

Contribution of Class to Meeting Professional Component:

This class satisfies both the engineering science and the engineering design requirements of the professional component.

1. Design (proportioning) of concrete mixtures to meet typical specifications for a given strength and durability (with and without fly ash),
2. Design of Superpave volumetric asphalt concrete mixture.
3. Pertinent properties to be considered in the selection/specification of Civil Engineering materials for given applications.

Laboratory projects (including major items of equipment and instrumentation used): (Concise written reports graded for form and content)

1. Common specified tests on cement (2 weeks)
(Normal consistency and time of setting using Vicat apparatus and Gillmore needle)
2. Common specified tests on aggregates (4 weeks)
(L.A. Abrasion machine, Sand Equivalent setup, etc.)
3. Concrete mix design (1 week)
(Automatic concrete mixer)
4. Bending Beam Rheometer Test for Superpave PG binder (1 week)
(Cannon Bending Beam Rheometer)
5. Properties of plastic concrete (1 week)
(Slump cone, Pressure meter and Roll-A-Meter)
6. Strength and stiffness of hardened concrete (1 weeks)
(Universal testing machine)
7. Video show: Fundamentals of Quality Concrete (1 week)
(TV-Video setup)
8. Superpave Mix Design (5 weeks)
9. An electronic spread-sheet is used to do aggregate blending and data reduction of the laboratory concrete test results. Analysis and interpretation of Superpave mixture design data using spread sheet and Superpave Software.
10. On-line access to all class lectures and materials through the World Wide Web.

Relationship of Course to Program Objectives:

The following program objectives are satisfied by this course: (2) civil engineering principle; and (3) methodologies of design.

Content:

Engineering Science: 1.5 credits or 50%

Engineering Design: 1.5 credit or 50%

Prepared by: M. Hossain **Date:** 11-13-98