

Tennessee Technological University
Department of Civil & Environmental Engineering
CEE 3030 – Civil Engineering Materials
Required
Fall Semester 2007, Spring Semester 2008

2007 Catalog Data: CEE 3030. Civil Engineering Materials . Lecture 2. Lab 2. Credit 3. Characteristics and uses of aggregates, portland cement concrete and bituminous materials for highways and other major engineering works. Prerequisites: ENGR 1120, CEE 3110.

Textbooks: 1. Portland Cement Association, *Design and Control of Concrete Mixtures*, Fourteenth Edition, 2002.
2. *Hot-mix Asphalt Materials, Mixture Design and Construction*, Roberts, Kandhal, Brown, Lee and Kennedy, National Center for Asphalt Technology, Second Edition, 1996.
3. J.F. Young, S. Mindess, R.J. Gray, A. Bentur, *The Science and Technology of Civil Engineering Materials*, Prentice Hall, 1998.

Reference: TBA

Coordinator: L.K. Crouch, Professor of Civil Engineering

Goal: To introduce students to basic properties of common civil engineering materials and some of the tests used to measure material properties.

Course learning objectives:

1. To introduce aggregate properties and discuss the effect of aggregate properties on the performance of composite materials containing aggregates
2. To familiarize the student with portland cement concrete (PCC) basic properties, common laboratory PCC tests, PCC mixture design, and statistical evaluation of PCC data
3. To familiarize the student with hot-mix asphalt (HMA) basic properties, HMA materials evaluation, HMA volumetric properties, and HMA mixture design
4. To introduce the student to pavement design and other commonly used construction materials

Course measurable outcomes:

Students will be expected to:

1. perform aggregate calculations such as gradation analysis, specific gravity and absorption, weight – volume relations, aggregate angularity, unit weight, and degradation;
2. demonstrate a basic understanding of PCC materials and tests, PC composition and specifications;
3. perform calculations to determine PCC air content, unit weight, yield, gravimetric air content, compressive strength, flexural strength, tensile strength, and modulus of elasticity ;
4. design basic PCC mixtures and evaluate compressive strength using ACI 214 and ASTM C 94;
5. demonstrate a basic understanding of HMA materials, tests and mixture design; and
6. perform HMA volumetric calculations such as G_{mb} , G_{mm} , percent air voids, etc.

Topics covered: (Two lecture classes per week, 55 minutes each; one lab per week, 2 hours each)

1. Aggregate property evaluation and significance (6 classes)
2. Properties and design of portland cement concrete (9 classes)
3. Bituminous materials/design of Hot-mix asphalt (6 classes)
4. Other common construction materials and FE preparation (5 classes)
5. Tests (2 classes plus two-hour final exam)

Contribution of the course to meeting professional component:

This course is a part of engineering topics of the curriculum.

ABET category content as estimated by faculty member who prepared this course description:

Engineering science: 2.0 credits (67%)

Engineering design: 1.0 credits (33%)

Relation of course to program outcomes:

- Outcome 1: The graduates will have a broad understanding of relevant principles of mathematics, science, and engineering.
- Outcome 2: The graduates will have a general comprehension of four technical areas appropriate to civil engineering.
- Outcome 4: The graduates will be capable of design activities and have the ability to identify, formulate, and solve civil engineering problems.
- Outcome 5: The graduates will have effective communication skills.
- Outcome 7: The graduates will have an understanding of experimental processes.
- Outcome 8: The graduates will have the ability to use techniques, skills, and modern engineering tools needed for engineering practice.
- Outcome 11: The graduates will have an understanding of the importance of the fundamental and applied research in the advancement of engineering knowledge.

Relation of course to ABET Criteria:

General Criteria

Bloom's Level of Achievement

- | | |
|--|---|
| (3a) Knowledge of math, science, engineering | 3 |
| (3b) Design, conduct experiments; analyze and interpret data | 3 |
| (3e) Identify, formulate, and solve engineering problems | 3 |
| (3g) Effective communication | 3 |
| (3k) Techniques, skills, modern tools for engineering practice | 3 |

Program Criteria

Bloom's Level of Achievement

- | | |
|---|---|
| 1. Apply knowledge of math and sciences | 3 |
| 2. Conduct civil engineering experiments and analyze and interpret the resulting data | 3 |

Computer usage:

1. Word processor generated laboratory reports required
2. Spread sheet data management

Laboratory projects:

1. Introduction, safety and lab clean up (2 labs)
2. Aggregate testing including gradation, abrasion resistance, specific gravity determination, dry-rodded unit weight, and angularity (5 labs)
3. Portland cement concrete testing including slump, unit weight, air content, temperature, compressive and split tensile strength, and static modulus of elasticity, and (4 labs)
4. Other common construction materials (3 labs)

Prepared by: L.K. Crouch

Date: September 2007