COURSE OUTLINE
CONS 280 - CIVIL ENGINEERING MATERIALS

Prepared By: Joseph Reilly

CANINO SCHOOL OF ENGINEERING TECHNOLOGY
DEPARTMENT OF ENGINEERING SCIENCE AND TECHNOLOGY
MARCH 2013
A. **TITLE:** CIVIL ENGINEERING MATERIALS

B. **COURSE NUMBER:** CONS 280

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** NO

E. **COURSE LENGTH:** 15 WEEKS

F. **SEMESTER(S) OFFERED:** Fall

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**

   2 – one hour lecture and 1 – 3 hour lab per week

H. **CATALOG DESCRIPTION:**

   This course examines properties, common applications and methods for properly selecting the materials typically used in the constructed environment. The laboratory develops awareness with and expertise in conducting standardized field and laboratory testing on common civil engineering materials. The materials studied include aggregates, Portland cement concrete, masonry and asphalt.

I. **PRE-REQUISITES:** MATH121, or MATH 123, or MATH135

J. **GOALS (STUDENT LEARNING OUTCOMES):**

   By the end of this course, the student will be able to:

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<th>Course Objective</th>
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<tr>
<td>a) Accurately record measurements from instruments commonly used in the civil</td>
<td>3. Professional Competence</td>
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<td>engineering laboratory including extensometer, mass scales, dial gages, calipers</td>
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<td>b) Discuss the significant properties, preparation and applications of</td>
<td>3. Professional Competence</td>
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<td>aggregate, concrete, asphalt and masonry in the constructed world.</td>
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<td>c) Conduct and interpret results from a sieve analysis.</td>
<td>3. Professional Competence</td>
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<td>d) Determine the specific gravity and absorption of fine and coarse aggregate.</td>
<td>3. Professional Competence</td>
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<td>e) Prepare a mix design for concrete</td>
<td>3. Professional Competence</td>
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<td>f) Perform slump, air content, temperature, and unit weight tests of</td>
<td>3. Professional Competence</td>
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<td>freshly mixed concrete.</td>
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g) Prepare and store concrete cylinders and beams for testing

h) Conduct tests to evaluate the important properties of hardened concrete specimens.

i) Determine and explain the strength and absorption tests of concrete masonry units.

j) Conduct tests to evaluate the important properties of asphalt binder.

k) Properly mix and prepare specimens of hot asphalt for testing.

l) Conduct and interpret tests which evaluate the key properties of hardened asphalt.


M. EQUIPMENT: None

N. GRADING METHOD: A - F

O. MEASUREMENT CRITERIA/METHODS:

Exams, Written Assignments, Lab Performance, and Lab Reports.

P. DETAILED COURSE OUTLINE:

I. Introduction

II. Aggregates
   A. Sources
   B. Geologic classification
   C. Uses
   D. Properties
   E. Handling

III. Portland Cement
   A. Production
   B. Chemistry
   C. Voids and properties in hydrated cement
   D. Types of cement

IV. Portland Cement Concrete
   A. Water
   B. Admixtures
   C. Proportioning mixes
   D. Mixing, handling, placing, and finishing
   E. Curing
F. Properties of hardened concrete  
G. Testing of hardened concrete  
H. Modern alternatives and innovations

V. Masonry  
A. CMUS  
B. Clay bricks  
C. Mortar  
D. Grout  
E. Plaster

VI. Asphalt Binders and Mixtures  
A. Types and uses of Asphalt  
B. Thermal and chemical considerations  
C. Performance characterization  
D. Classifications of asphalt  
E. Asphalt concrete  
F. Mix Design  
G. Characterization  
H. Production  
I. Recycling  
J. Additives

Q. LABORATORY OUTLINE:

1. Sieve Analysis of Aggregates  
2. Bulk Unit weight, voids, and Specific Gravity and Absorption of Aggregates  
3. Concrete mix 1 -  
   a. Mix design  
   b. Slump test  
   c. Unit weight test  
   d. Air content determination  
   e. Making and curing concrete cylinders  
4. Concrete mix 2 – effect of air entrainment  
5. Concrete mix 3 – use of superplasticizers  
   a. Use of SCM  
   b. Casting beam specimens  
6. Capping concrete cylinders and Compressive Strength of Concrete  
7. Flexural Strength of Concrete (beams)  
8. Rebound Test of hardened Concrete  
9. Penetration resistance of hardened concrete  
10. Testing concrete masonry units  
11. Tensile strength of Portland Cement mortar  
12. Asphalt Binder –  
   a. Viscosity  
   b. Shear strength  
13. Penetration test of asphalt cement  
14. Asphalt – viscosity
15. Preparing Hot Mix Asphalt using the Marshall Compacator
16. Bulk specific gravity of compacted bituminous materials
17. Marshall Stability and flow of asphalt concrete