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:

<table>
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<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tr>
<td>a) Accurately record measurements from instruments commonly used in the civil engineering laboratory including extensometer, mass scales, dial gages, calipers, strain gages.</td>
<td>3. Professional Competence</td>
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<tr>
<td>b) Discuss the significant properties, preparation and applications of aggregate, concrete, asphalt and masonry in the constructed world.</td>
<td>3. Professional Competence</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 freshly mixed concrete.</td>
<td>3. Professional Competence</td>
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</table>
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.

3. Professional Competence


L. **REFERENCES:** Portland Cement Association Material Handbook

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 Compactor
16. Bulk specific gravity of compacted bituminous materials
17. Marshall Stability and flow of asphalt concrete