COURSE OUTLINE

CONS 216 – Soils in Construction

Prepared By: Adrienne C. Rygel, Ph.D.
A. **TITLE**: Soils in Construction

B. **COURSE NUMBER**: CONS 216

C. **CREDIT HOURS**: 4

D. **WRITING INTENSIVE COURSE**: Yes

E. **COURSE LENGTH**: 15 Weeks

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

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY**: 3, 50-minute lectures and 1, 3-hour lab

H. **CATALOGUE DESCRIPTION**:

Students learn about soil types, soil properties, soil classification, and basic soil property tests. Students learn how to conduct site and subsurface investigations. Introductory concepts of hydrogeology are introduced, students learn to measure and calculate hydraulic conductivity, and site dewatering techniques are discussed. Other site work related topics include: the compaction control process, slope stability and erosion control, excavation safety and support systems, and roadway subgrades materials and testing. Students learn about types of shallow foundations, deep foundations, and retaining structures and aspects of their construction as related to soil work. The laboratory component of the course explores soil testing methods and analytical problems related to lecture topics. Students learn and practice basic reporting styles used in industry. This is a writing intensive course.

I. **PRE-REQUISITES**:

MATH 121 (College Algebra), MATH 123 (Pre-Calculus), or MATH 135 (Technical Math I), and sophomore status, or permission of the instructor.

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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| a. Test a soil sample and analyze the data to determine the following soil index properties: grain size distribution, coefficient of uniformity, coefficient of curvature, moisture content, liquid limit, plastic limit, specific gravity. | 2. Critical Thinking  
3. Professional Competence |
| b. Calculate the following soil properties based on mass-volume relationships: void ratio, porosity, degree of saturation, water content, wet unit weight and dry unit weight, wet unit mass and dry unit mass, and specific gravity. | 2. Critical Thinking  
3. Professional Competence |
| c. Classify a soil sample using the Unified Soil Classification System and the AASHTO Classification System. | 2. Critical Thinking  
3. Professional Competence |
| d. Discuss and analyze results from field and lab tests used in subsurface investigations. | 2. Critical Thinking  
3. Professional Competence |
<p>| e. Determine the hydraulic conductivity of a soil sample using the | 2. Critical Thinking |</p>
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<th>constant head permeameter test; and discuss dewatering techniques for earthwork projects.</th>
<th>3. Professional Competence</th>
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<td>f. Conduct compaction control tests to determine the maximum dry unit weight and in place unit weight of a soil sample; and explain the compaction control process.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>g. Discuss techniques for slope stability and erosion control.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>h. Explain how soil is classified for excavation construction purposes.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>j. Prepare and present an oral presentation regarding a soil design or construction topic with appropriate visual aids.</td>
<td>1. Communication 3. Professional Competence 4. Inter-Intrapersonal Skills</td>
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K. **TEXTS:**


L. **REFERENCES:**


M. **EQUIPMENT:**

Standard oven, microwave oven, US standard sieve sets, Casagrande liquid limit devices, plastic limit devices, constant head permeability devices, Standard Proctor equipment, Modified Proctor equipment, sand cone equipment are provided by the department.

N. **GRADING METHOD:** A-F
O. **MEASUREMENT CRITERIA/METHODS:**
   - Examinations,
   - Homework assignments,
   - In-class exercises,
   - Quizzes
   - Term Project: Paper and Presentation

P. **DETAILED COURSE OUTLINE:**
   I. Part 1: Soil Properties and Classification
      A. Introduction
      B. Origin of Soil Deposits
         1. The soil formation cycle
            a) Weathering
            b) Erosion
            c) Transport and Deposition
         2. Transport and deposition mechanisms
            a) Alluvial (Water)
            b) Aeolian (Wind)
            c) Glaciers
            d) Gravity
      C. Soil Properties
         1. Grain Size Distribution
            a) Coarse Grain
            b) Fine Grain
         2. Coarse Grained Soil Index Parameters
            a) Sieve Analysis
            b) Grading
            c) Coefficient of Curvature and Coefficient of Uniformity
            d) Effective grain size and median grain size
         3. Fine Grained Soil Index Parameters
            a) Hydrometer Analysis
            b) Liquid Limit
            c) Plastic Limit
            d) Shrinkage Limit
      D. Soil Classification
         1. AASHTO Classification System
         2. Unified Soil Classification System
         3. Agricultural Classification System
         4. Geologists’ Classification System
      E. Soil Particle Shape and Soil Structure
      F. Soil Mass/Volume Relationships

II. Part 2: Subsurface Investigations
   A. Site Investigations
      1. Components
      2. Resources
   B. Subsurface Investigation Methods
      1. Auger and Core Boring
2. Test Pits
3. Standard Penetration Test
4. Cone Penetrometer Test
5. Vane Test
6. Geophysical Tests

C. Basic Hydrogeology Concepts
   1. Aquifers
   2. Confining Layers
   3. Coefficient of Permeability

III. Part 3: Site Work and Construction
   A. Methods for dewatering soil
      1. Vacuum trucks
      2. Trenches and Sump Pits
      3. Wells
      4. Caissons
      5. Cofferdam
      6. Seepage Barriers
      7. Electroosmosis
   B. Soil Compaction
      1. Density and Soil Moisture
      2. Compaction Control Process
      3. Compaction Methods
      4. Testing
   C. Slope Stability and Erosion Control
      1. Embankment Control Issues
      2. Methods of Slope Stability
      3. Methods of Erosion Control
      4. Pertinent Regulations
   D. Excavations
      1. Excavation Safety and Regulations
      2. OSHA Soil Classification for Excavation Work
      3. Excavation Support Systems
   E. Roadway Subgrades
      1. Materials
      2. Testing
      3. Subgrade Construction
   F. Soil Work Associated with Foundations and Retaining Structures
      1. Types of Shallow Foundations
      2. Types and Construction of Deep Foundations
      3. Types and Construction of Retaining Structures

Q. LABORATORY OUTLINE:
   1. Lab Report Writing and Finding Term Project References in the Library
   2. Sieve Analysis
   3. Hydrometer Analysis
   4. Water Content Determination and Mass-Volume Problems
   5. Specific Gravity of Solids and Atterberg Limits (Liquid Limit and Plastic Limit)
   6. Control Low Strength Material (CLSM)
7. Constant Head Permeability
8. Standard Proctor Compaction Test
9. In Place Unit Weight by the Sand Cone Method
11. Subsurface Investigation: Soil Boring/Test Pit Logging and Soil Classification
12. Compaction Control Plan
13. Student Term Project Presentations
14. Student Term Project Presentations