COURSE OUTLINE
CONS 294 – SOIL INVESTIGATION

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CANINO SCHOOL OF ENGINEERING TECHNOLOGY
April 2012
CONS 214 – SOIL INVESTIGATION

A. **TITLE:** Soil Investigation

B. **COURSE NUMBER:** CONS 294  
   **SHORT TITLE:** Soil Investigation

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE (OPTIONAL):** This is the writing intensive course for CONSTRUCTION ENGINEERING TECHNOLOGY and CONSTRUCTION TECHNOLOGY MANAGEMENT.

E. **COURSE LENGTH:** 15 Weeks

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

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**  
   Lecture: 2 – 50 minute lectures  
   Laboratory: 1 – 2 hr 50 minute laboratory  
   Activity –  
   Lecture - average two hours per session for homework, note review, advance preparation and preparation of term paper and presentation.  
   Lab Sessions - average of two hours for lab report preparation.

H. **CATALOGUE DESCRIPTION:** The basic properties of soil that affect construction activities are presented. Subject areas include physical condition of the soil, soil phase conditions, basic soil tests, soil classification systems, soil and water relationships, soil strength concepts, and settlement and compressibility. The laboratory work consists of standard test procedures including moisture content, specific gravity, sieve analysis, Atterberg Limits tests, compaction tests, percolation tests and in-place density tests.

I. **PRE-REQUISITES/CO-COURSES:** Completion of Intermediate Algebra (MATH 106) or Technical Math (MATH135, and CITA109 (Intermediate Spreadsheets).

J. **GOALS (STUDENT LEARNING OUTCOMES):**  
   By the end of this course, the student will:

<table>
<thead>
<tr>
<th><strong>Course Objective</strong></th>
<th><strong>Institutional SLO</strong></th>
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<tbody>
<tr>
<td>a. Test a soil sample and analyze the data to estimate the following soil index properties:</td>
<td>3. Professional Competence</td>
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<tr>
<td>• Coefficients of Uniformity and Curvature</td>
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<tr>
<td>• Moisture Content</td>
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<tr>
<td>• Liquid Limit</td>
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<td>• Plastic Limit</td>
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<tr>
<td>• Specific Gravity</td>
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<td>• Maximum Dry Unit Weight</td>
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b. Select, based on laboratory test results, the correct classification for a soil sample using the Unified Soil Classification System and the AASHTO Classification System.

2. Critical Thinking
3. Professional Competence

c. Estimate the hydraulic conductivity of a soil based on field and or laboratory test data.

3. Professional Competence

d. Calculate the shrinkage factor for borrow.

3. Professional Competence

e. Analyze the need for back slopes and support of an excavation

3. Professional Competence

f. Compose an Engineering Report regarding a soil construction topic using appropriate syntax and grammar.

1. Communication
3. Professional Competence

g. Formulate and present an oral presentation with appropriate visual aids regarding a soil construction topic.

1. Communication
2. Critical Thinking

h. Prescribe the appropriate driving resistance for a specified pile type and capacity when using a specific make and model of pile hammer.

3. Professional Competence

i. Report lab results in effectively in a manner prescibed including professionally organized memoranda and lettes

1. Communication
3. Professional Competence

K. **TEXTS:**


L. **REFERENCES:** None

M. **EQUIPMENT:** Standard oven, Microwave Oven, Sieve Sets, Liquid Limit Devices, Plastic Limit Devices, Constant Head Permeability Devices, Fall Head Permeability Devices, Standard Proctor Equipment, Modified Proctor Equipment, Sand Cone Equipment are provided by the department. The student is expected to provide the following:

- A calculator capable of performing addition, subtraction, multiplication, division, trigonometric functions, inverses, exponentiation and roots.
- Quadrille ruled Engineering Computation paper for assignments.
- A sharp pencil(s) with H or HB lead for computations.
- A flash drive with at least 32 MB capacity dedicated to this course.
- The following drafting equipment:
  - Engineer’s Scale
  - 2 triangles with a minimum blade length of 8”
  - Circle template or compass
  - Protractor
  - French curve

N. **GRADING METHOD:** (P/F, A-F, etc.) A-F

O. **MEASUREMENT CRITERIA/METHODS:**

Student learning in this course will be assessed by a number of homeworks, quizzes, exams (3 hourlies and a final), lab reports, papers and presentations. The grading of these assessments will be based on the following four factors:

1. Evidence of student understanding of the topic assessed
2. Evidence of student thinking
3. Communication of problem solution
4. Demonstration that the student cares about the quality of the work

Approximate (subject to change) point system follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Examinations</td>
<td>40%</td>
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<tr>
<td>Homework &amp; quizzes</td>
<td>25%</td>
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<tr>
<td>Labs</td>
<td>20%</td>
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<tr>
<td>Paper and Presentation</td>
<td>10%</td>
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<tr>
<td>Instructor’s evaluation-lab</td>
<td>3%</td>
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<td>Instructor’s evaluation-class</td>
<td>2%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
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P. **DETAILED TOPICAL OUTLINE:**

I. Introduction
II. Origin of Soil Deposits
   A. Types of Rock
   B. The soil formation cycle
   C. Transport and deposition mechanisms
      1. Gravity
      2. Water
         a. Alluvial
         b. Lacustrine
         c. Marine
      3. Glaciers
         a. Till
         b. Moraines
         c. Kames and Eskers
4. Wind
D. Volcanic deposits

III. Soil Composition
A. Particle Size Distribution
   1. Coarse Grain
   2. Fine Grain
B. Soil Types
   1. Cohesive
   2. Cohesionless
C. Index Properties
   1. Effective and median grain sizes
   2. Coefficients of uniformity and curvature

IV. Index Properties
A. Soil Weight/Volume Relationships
B. Terminology

V. Soil Classification
A. Agricultural Classification System
B. AASHTO Classification System
C. Unified Soil Classification System

VI. Dewatering

VII. Stresses in soil masses
A. Total stress
B. Neutral stress
C. Effective stress

VIII. Earthwork and Compaction
A. Construction process
B. Compaction
   1. Concepts
   2. Equipment
   3. Testing
C. Fill control inspection

IX. Subsurface Exploration
A. Utility markouts
B. Types of exploration
C. Soil boring equipment
D. Standard penetration test
   1. Equipment and methods
   2. Application of data
   3. Corrections for overburden pressure
E. In situ exploration methods
F. Geophysics

X. Engineering properties
A. Shear strength
B. Permeability
C. Compressibility

XI. Foundations
A. Shallow foundations
   1. Design considerations
   2. Bearing capacity analysis
B. Deep foundations
   1. Types
2. Installation methods
3. Pile driving
   a. Methods
   b. Dynamic pile driving formulae
   c. Pile load testing

XII. Excavation support
    A. Slope stability
    B. Safety requirements
    C. Lateral soil pressures

XIII. Geosynthetics
    A. Geotextiles
    B. Geogrids
    C. Geonets
    D. Geomembranes

XIV. Erosion
    A. Erosion processes
    B. Silt fences
    C. Drainage control
    D. Application of geosynthetics
    E. Erosion control plans

Q. LABORATORY OUTLINE:

1. Unit Weight of Water
2. Introduction to the Soil Laboratory
3. Particle Size Analysis
4. Water Content Determination
5. Specific Gravity of Solids
6. Atterberg Limits
7. Constant Head Permeability
8. Controlled Low Strength Material (CLSM)
9. Standard Proctor Compaction Test
10. In Place Unit Weight by the Sand Cone Method
11. Student Presentations & Break CLSM Cylinders
12. Student Presentations
13. Student Presentations
14. Percolation Test