COURSE OUTLINE

CONS 316 – Foundation Design

Prepared By:  Adrienne C. Rygel, Ph.D.
A. **TITLE:** Foundation Design

B. **COURSE NUMBER:** CONS 316

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 Weeks

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

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
2, 50-minute lectures and 1, 1-hour and 50-minute recitation

H. **CATALOG DESCRIPTION:**
Principles of soil mechanics are taught: stress distribution, consolidation and settlement, shear strength, and lateral earth pressure. Students apply concepts of soil mechanics to foundation design. Soil-supported foundations for buildings and structures are discussed, which include different foundation types, design methods, design considerations and criteria, and installation techniques. Students learn about shallow foundations, deep pile and drilled shaft foundations, retaining structures, and slope stability.

I. **PRE-REQUISITES:**
CONS 216 Soils in Construction, and CONS 272 Strength of Materials, and MATH 161Calculus I, 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. Analyze data to determine the stress distribution in soil from an applied load. | 2. Critical Thinking  
3. Professional Competence |
| b. Calculate the amount of consolidation settlement and the time associated with settlement in fine grained soils. | 2. Critical Thinking  
3. Professional Competence |
| c. Analyze shear strength test data with Mohr’s circles to determine the cohesion, internal friction, and shear strength of a soil sample. | 2. Critical Thinking  
3. Professional Competence |
| d. Calculate lateral earth pressures acting on a structure. | 2. Critical Thinking  
3. Professional Competence |
| e. Design and analyze a spread footing foundation for settlement and bearing capacity. | 2. Critical Thinking  
3. Professional Competence |
| f. Design the size of a shallow foundation given bearing capacity, allowed settlement, and soil properties. | 2. Critical Thinking  
3. Professional Competence |
| g. Design and analyze a pile foundation for settlement and bearing capacity. | 2. Critical Thinking  
3. Professional Competence |
| h. Prescribe the appropriate driving resistance for a specified pile | 2. Critical Thinking  |

type and capacity when using a specific make and model of pile hammer.

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<th>3. Professional Competence</th>
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<td>i. Design a retaining structure.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>j. Conduct slope stability analyses.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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K. **TEXTS:**

L. **REFERENCES:**

M. **EQUIPMENT:**
None

N. **GRADING METHOD:** (P/F, A-F, etc.)
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: Principles of Soil Mechanics
   A. Stress Distribution
      1. Principles of Stress Distribution In Soil From Applied Loads
      2. Calculation of Stress Distribution Under Concentrated Loads
      3. Calculation of Stress Distribution Under Uniform Loads
   B. Consolidation and Settlement
      1. Causes of Consolidation and Settlement
2. Impact of Soil Type on Consolidation and Settlement
3. Calculating the Amount and Rate of Consolidation and Settlement
C. Shear Stress and Shear Strength
   1. Definition and Calculation of Shear Stress and Shear Strength
   2. Field and Laboratory Tests
   3. Shear Strength of Common Soil Types
D. Lateral Earth Pressure
   1. Lateral Earth Pressure at Rest
   2. Active Lateral Pressure
   3. Passive Lateral Pressure

II. Part 2: Shallow Foundation Design
   A. Design Approach and Considerations
   B. Bearing Capacity Design
   C. Load and Resistance Factor Design
   D. Contact Pressure
   E. Sizing of Footings
   F. Settlement Check

III. Part 3: Deep Foundation Design
   A. Design Approach and Considerations
   B. Bearing Capacity Design
   C. Pile Grouping and Spacing
   D. Settlement Check

IV. Part 4: Retaining Structure Design
   A. Stability Analysis
   B. Backfill and Drainage
   C. Design and Construction of Different Types of Retaining Structures
      1. Gravity walls
      2. Cantilever walls
      3. Reinforced earth walls
      4. Slurry trench walls
      5. Anchored bulk heads

V. Part 5: Slope Stability Design
   A. Analysis of mass resting on an inclined layer of impermeable soil
   B. Slopes in homogenous cohesionless soils
   C. Slopes in homogenous soils possessing cohesion
   D. Method of slices
   E. Slope Stability Techniques

Q. **LABORATORY OUTLINE**: N/A