COURSE OUTLINE
CONS 285– Engineering Geology

Prepared By: Adrienne C. Rygel, Ph.D.
A. **TITLE:** Engineering Geology

B. **COURSE NUMBER:** CONS 285

C. **CREDIT HOURS:** 4

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 Weeks

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

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   - Lecture: 3 hours
   - Laboratory: 2 hours

H. **CATALOG DESCRIPTION:**
   This course introduces engineers to earth processes and phenomena that impact the design, construction, and performance of engineered structures. Students learn to identify common earth materials, study the mechanical properties of rocks, and learn how earth materials respond to stress and strain resulting from natural forces and engineered structures. The impact of weather, erosion, landforms, structural deformation, earthquakes, and coastal processes on engineered structures are studied. The natural stability of slopes and mass movement hazards that impact the design and construction of structures are discussed. Additional topics include, but are not limited to: the development and composition of earth, geologic time, geologic mapping, an introduction to soil mechanics, and an introduction to surface water and groundwater principles. Laboratory exercises reinforce lecture material; and provide students with skills required by field engineers.

I. **PRE-REQUISITES:** MATH 121 (College Algebra), MATH 123 (Pre-Calculus), or MATH 135(Technical Math 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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| 1. Read and interpret topographic maps. | 2. Critical Thinking  
3. Professional Competence |
| 2. Identify common minerals, as well as major types of igneous, metamorphic, and sedimentary rocks; and have knowledge of their uses as construction related materials. | 2. Critical Thinking  
3. Professional Competence |
| 3. Define the major types of plate boundaries, the processes that occur at each, and the forces that drive plate motion. | 3. Professional Competence |
| 4. Use the appropriate terminology to describe faults and folds and be able read and interpret geologic maps and cross-sections. | 2. Critical Thinking  
3. Professional Competence |
| 5. Use a compass in orientation analysis of geologic features. | 2. Critical Thinking  
3. Professional Competence |
<p>| 6. Create a geologic map and cross-section. | 2. Critical Thinking |</p>
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<th></th>
<th>3. Professional Competence</th>
<th>2. Critical Thinking</th>
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<td>7.</td>
<td>Create a structural contour map.</td>
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<td>8.</td>
<td>Use structural contour maps to determine the strike and dip of a bedding plane or structural surface, determine the thickness of a bed, and predict subsurface orientations of surfaces using the “Rule of V’s” for beds and topographic contours.</td>
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<td>9.</td>
<td>Utilize structural contour maps to map outcrop patterns, shade areas for potential industrial mining, and determine boring depths.</td>
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<td>10.</td>
<td>Explain the laboratory methods used to determine the amount of stress and strain on rocks.</td>
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<td>11.</td>
<td>Analyze compressive strength test results using Mohr’s circles to define the failure envelope of a rock specimen; determine the angle of internal friction, cohesion, and compressive strength of a rock specimen; and determine if a rock will fail under given stress conditions.</td>
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<td>12.</td>
<td>Analyze seismic data to determine the location of the epicenter of an earthquake.</td>
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**K. TEXTS:**

**L. REFERENCES:**

**M. EQUIPMENT:**
Laboratory equipment, provided by the department, includes: mineral sample kits, sedimentary rock kits, igneous rock kits, metamorphic rock kits, Silva compasses, maps
N. **GRADING METHOD:**
   A-F

O. **MEASUREMENT CRITERIA/METHODS:**
   - Examinations
   - Laboratory exercises
   - Homework assignments
   - In-class exercises
   - Quizzes

P. **DETAILED COURSE OUTLINE:**

I. **Part 1: Introduction**
   A. Application of Geology to Engineering
   B. Topographic Maps
      1. Map Scale
      2. Map Coordinates
      3. Reading and Using Topographic Maps

II. **Part 2: Earth Materials**
   A. Minerals
   B. Igneous Rocks
      1. Rock Types and Properties
      2. Volcanism
      3. Engineering and Igneous Rocks
   C. Sedimentary Rocks
      1. Rock Types and Properties
      2. Engineering and Sedimentary Rocks
   D. Metamorphic Rocks
      1. Rock Types and Properties
      2. Engineering and Metamorphic Rocks

III. **Part 3: Earth Processes**
   A. Seafloor Spreading and Plate Tectonics
   B. Geologic Time and Relative and Absolute Age Dating
   C. Structural Geology – Crustal Deformation
      1. Orientation of Structures
      2. Faults
      3. Folds
      4. Geologic Maps and Cross-Sections

IV. **Part 4: Field Engineering Geology**
   A. Field Geology Mapping Problems
      1. Creating structural contour maps
      2. Determining strike and dip from structural contour maps
      3. Determining bed thickness from structural contour maps
      4. Interpreting subsurface orientations using the “Rule of V’s” for outcrop patterns and
topographic contours
5. Mapping outcrop patterns
6. Mapping areas for industrial mining operations
7. Determining boring depths
8. Creating geologic cross-sections from structural contour maps

B. Geophysics
1. Earthquakes
2. Seismic Analysis
3. Building material and construction basics in earthquake prone locations

C. Engineering Properties and Mechanics of Rocks
1. Stress and Strain on Rocks
2. Engineering Classification of Rocks Based on Stress and Strain

D. Geology of Northern New York (field trip)

Q. LABORATORY OUTLINE:
1. Topographic Maps and Map Scales
2. Mineral Identification
3. Igneous Rocks Identification
4. Sedimentary Rock Identification
5. Metamorphic Rocks Identification
6. Geologic Time and Relative and Absolute Age Dating
7. Orientation Analysis with Compasses
8. Geologic Structures, Geologic Maps, Cross-sections, and Block Diagrams
9. Structural Contour Map Creation
10. Structural Contour Map Interpretation – Strike+Dip and Bed Thickness
11. Structural Contour Map – mapping outcrop pattern and area for industrial mining
12. Structural Contour Map – interpretation of map pattern and creating a cross-section
13. Earthquakes – data analysis and locating the epicenter