STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
CIVL 384– Engineering Geology

Created by: Adrienne C. Rygel

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Canino School of Engineering Technology

Department: Civil and Construction Technology

Semester/Year: Fall 2019

A. **TITLE**: Engineering Geology

B. **COURSE NUMBER: CIVL 384**

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 4
 # Lecture Hours: 3 **per week**
 # Lab Hours: 2 **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE 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.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

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

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
1. Read and interpret topographic maps.	2488: 1a, 2b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
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.	2488: 1a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
3. Define the major types of plate boundaries, the processes that occur at each, and the forces that drive plate motion.	2488: 1a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
4. Use the appropriate terminology to describe faults and folds and be able read and interpret geologic maps and cross-sections.	2488: 1a, 2b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
5. Use a compass in orientation analysis of geologic features.	2488: 1b, 2b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
6. Create a geologic map and cross-section.	2488: 2b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets

7. Create and utilize a structural contour map for geologic subsurface investigations and mining related activities.	2488: 1a, 2ab, 6b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
8. Explain the laboratory methods used to determine the amount of stress and strain on rocks.	2488: 1a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
9. 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.	2488: 3b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
10. Analyze seismic data to determine the location of the epicenter of an earthquake.	2488: 1a, 2b		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

☒ Classroom/Lab
☐ Internship
☐ Clinical Placement
☐ Practicum
☐ Service Learning
☐ Community Service
☐ Civic Engagement
☐ Creative Works/Senior Project
☐ Research
☐ Entrepreneurship (program, class, project)

K. TEXTS:

- Marshak, Stephen, Earth Portrait of a Planet, 6th Edition, W.W. Norton and Company, 2018.
- Rygel, Adrienne, 2018. "CONS 285 Engineering Geology Laboratory Manual", SUNY Canton.

L. REFERENCES:

- Kewhew, Alan E. (2006). Geology for Engineers and Environmental Scientists, 3rd Edition. Upper Saddle River, New Jersey: Prentice Hall.
- Ramsay, John G. and Huber, Martin I. (1983). The Techniques of Modern Structural Geology, Volume 1: Strain Analysis. New York, New York: Academic Press, Inc.
- Rahn, Perry H. (1996). Engineering Geology An Environmental Approach, 2nd Edition. Upper Saddle River, New Jersey: Prentice Hall PTR.
- Ramsay, John G. and Huber, Martin I. (1987). The Techniques of Modern Structural Geology, Volume 2: Folds and Fractures. New York, New York: Academic Press, Inc..
- Twiss, Robert J. and Moores, Eldrige M. (1973). Structural Geology. New York, New York: W.H. Freeman and Company.
- West, Terry R. (1995). Geology Applied to Engineering. Upper Saddle River, New Jersey: Prentice Hall.
- Ludman, Allan and Marshak, Stephen, Laboratory Manual for Introductory Geology, 2nd edition, W.W. Norton and Company, 2011.

M. EQUIPMENT: None ☐ **Needed:** 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. SUGGESTED 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. <u>LABORATORY OUTLINE</u>: None ☐ Yes ☒

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
14. Rock Mechanics: stress, strain, and Mohr diagrams