COURSE OUTLINE

CONS 385 – Hydrology and Hydrogeology

Prepared By: Adrienne C. Rygel, Ph.D.
CONS 385 – Hydrology and Hydrogeology

A. **TITLE**: Hydrology and Hydrogeology

B. **COURSE NUMBER**: CONS 385

C. **CREDIT HOURS**: 4

D. **WRITING INTENSIVE COURSE**: No

E. **COURSE LENGTH**: 15 Weeks

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

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

H. **CATALOG DESCRIPTION**:  
   This course includes the study of surface and groundwater systems, with an emphasis on civil and environmental engineering related topics. Surface water topics include: principles of hydrology, hydrologic cycle, surface water environments, surface water flow, flood hazard analysis, watershed management and river engineering, and drainage basins. Specific groundwater topics include: principles of hydrogeology, aquifers, aquitards, groundwater flow regimes, well construction and testing, porosity and permeability of earth materials, and aquifer property testing and analysis. Laboratory and field exercises are used to introduce students to technologies and analytical methods used by industry to understand surface and groundwater systems.

I. **PRE-REQUISITES**:  
   Engineering Geology (CONS 285) or Civil Engineering Materials (CONS 280) or Soils in Construction (CONS 216); and Calculus I (MATH 161); 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>
<th>Institutional SLO</th>
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<tr>
<td>a. Explain the hydrologic cycle.</td>
<td>2. Critical Thinking</td>
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| b. Delineate a drainage basin divide on topographic maps, determine stream order, and determine the gradient of a stream. | 2. Critical Thinking  
  3. Professional Competence |
| c. Describe general practices of drainage basin management. | 2. Critical Thinking  
  3. Professional Competence |
| d. Interpret and use stream hydrographs and duration curves in problem solving. | 2. Critical Thinking  
  3. Professional Competence |
| e. Conduct common methods for streamflow measurement. | 2. Critical Thinking  
  3. Professional Competence |
| f. Conduct flood risk analyses. | 2. Critical Thinking  
  3. Professional Competence |
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<th>g. Determine and/or define common properties of aquifers.</th>
<th>2. Critical Thinking</th>
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<td>h. Determine the coefficient of permeability and the amount of drawdown for confined and unconfined aquifers using principles of groundwater flow.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>i. Construct and use a flow net to determine the discharge under/around a structure.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>j. Apply the Theis and Jacob Methods to describe groundwater flow to a well.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>k. Interpret data from a Slug Test.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>l. Research a topic related to the course by conducting a technical literature review and prepare a written deliverable (standard report, fact sheet, or poster) and present the research findings to the class in an oral presentation.</td>
<td>1. Communication 2. Critical Thinking 3. Professional Competence 4. Inter/ Intrapersonal Skills</td>
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**K. TEXTS:**


**L. REFERENCES:**


**M. EQUIPMENT:**

Laboratory equipment, provided by the department will include:

- Constant Head Permeability Devices,
- Fall Head Permeability Devices,
- Porosimeter

**N. GRADING METHOD:**

A-F

**O. MEASUREMENT CRITERIA/METHODS:**

- Examinations
• Laboratory exercises
• Homework assignments
• In-class exercises
• Quizzes
• Term Project

P. DETAILED COURSE OUTLINE:

I. Hydrology
   A. Part 1: Hydrologic Cycle
      1. Evaporation
      2. Transpiration
      3. Evapotranspiration
      4. Condensation
      5. Precipitation
   Part 2: Streams and Drainage Basins
      1. Formation of Streams
      2. Drainage Basins
      3. Anatomy of Streams
      4. Stream Erosion and Sediment Transport
      5. Landscape Evolution and Types of Streams
      6. Stream Hydraulics
      7. Measurement of Streamflow
   Part 3: Watershed Management and River Engineering
      1. Stream Analysis
      2. Hydrographs
      3. Rainfall-Runoff Relationship
      4. Duration Curves
      5. Groundwater Recharge from Baseflow
      6. Flood Risk Analysis
      7. River Engineering

II. Hydrogeology
   Part 4: Aquifer Properties
      1. Porosity
      2. Permeability
   Part 5: Groundwater Flow
      1. Darcy’s Law
      2. Constant Head and Falling Head Permeameters
      3. Flow Nets
      4. Theis Method
      5. Jacob Method
      6. Slug Tests

Q. LABORATORY OUTLINE:
   1. Evaporation and Water Budget
   2. Precipitation Analysis I
   3. Precipitation Analysis II
   4. Delineating Drainage Basins, Determining Stream Order, Stream Profiles and Gradient
   5. Stream Gauging
7. Flood Risk Analysis
8. Aquifer Property Testing
9. Permeability Testing
10. Flow Nets
11. Theis and Jacob Methods
12. Slug Test Analysis
13. Term Project Presentations (2 laboratory periods)