Geo315/ENV 315 Groundwater Hydrology 3 credits  
(Prerequisites: GEO 102 or GEO 122; MAT 127 or MAT 132 or MAT 142 or MAT 171 or AMS 161)

**COURSE GOAL:**
The primary goal of this class is for students to understand the concepts and physical principles of ground water hydrology. The class also introduces quantitative methods to study regional fluid flow and groundwater contamination.

**COURSE CONTEXT:**
This course is one of the foundational courses for the Geology and the Earth and Space Sciences majors and is generally taken after students have the basic understanding of geology and preparation in physics and calculus. Graduate students in the Masters of Teaching program can obtain this preparation by enrolling in the graduate equivalent course (GEO514), in which they additionally indicate mastery of the material at the Masters level by a research paper that goes into depth on one aspect of the material covered.

**INSTRUCTIONAL COMPONENTS:**

* A. **Development of skills in solving hydrological issues**
  - Constructing regional hydrological cycle models based on the observations
  - Building a regional flow model based on geology and observations
  - Solving ground water flow using available methods
  - Writing a scientific article related to hydrological issues (Geo 514 students only)

* B. **Concept development**
  - Hydrological cycles
  - Aquifer
  - Physical principle governing the ground water
  - Ground water contamination

* C. **Practical application**
  - Aquifer tests
  - Slug tests
  - Regional flow models

**COURSE LOGISTICS:**
The course content is distributed through one 3-hour class per week.

**EXPECTED COURSE OUTCOMES:**

By the end of the course, students will be able to:

1) explain the hydrological cycle, including
   - evapotranspiration
   - runoff and stream flow
   - the hydrogeological framework of Long Island

2) describe basic properties of an aquifer, including
   - porosity
• specific yield
• hydraulic conductivity
• anisotropy
• heterogeneity
• effective stress
• confined and unconfined aquifers

3) integrate basic concepts and physical principles governing ground water, including
• hydraulic head
• specific discharge and seepage velocity
• Darcy's law
• governing equations for groundwater flow, steady state and transient flow, flow net

4) describe field tests to determine the hydrological properties of an aquifer, including
• pumping test,
• slug test

5) explain basic concepts of ground water contamination, including
   a) water quality standards
   b) advection, diffusion and mechanical dispersion
   c) capture zone analysis, salt water intrusion

GOALS FOR BROADER SKILLS
   A. To develop skills in integrating data and models
   B. To gain experience in applied quantitative reasoning
   C. To understand how to evaluate field tests

ASSESSMENT OF ATTAINMENT OF COURSE GOALS:
Student attainment of course goals is assessed through homework assignments, two written
examinations and a term paper (term paper is for Geo 514 only) throughout the semester.
Homework assignments are distributed such that they directly follow exposure to the materials
and therefore, act to apply and reinforce the concepts discussed during lecture. Exams provide
a chance for student to review the material and express their understanding through written
answers.

Typical Class Plan:
Geo/Env 315: Students are expected to attend lectures, solve 5 problem sets and 2
examinations.
Geo 514: All requirements above plus a term paper.
**Geo514 Intro to Physical Hydrogeology** Course Details

**Spring 2014**

**Mondays, 5:30-8:30 PM Building ESS 183**

Instructor: Prof. Lianxing Wen ([Lianxing.Wen@stonybrook.edu](mailto:Lianxing.Wen@stonybrook.edu))

Office Hours: ESS 230; Wednesdays and Fridays, 3:00 - 4:00 PM.

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**REQUIRED MATERIALS:**


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**COURSE EVALUATION**

**Grading:**

Geo/Env 315: Each examination accounts for 20% of the final grade, and all problem sets combined account for 60%.

Geo 514: 80% of all above + 20% for term paper.

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**Term Paper (Geo 514 Only):**

A term paper is required for Geo 514 students. The term paper should be in a form of a typical scientific paper, i.e., including abstract, introduction, main text, conclusion, as well as figures & references. It will be graded on the basis of scientific accuracy & insight and the quality of the writing and appearance.

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**COURSE SCHEDULE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>1/27</td>
<td>Introduction; the hydrological cycle (Chapter 1); Evapotranspiration</td>
<td>Chapter 2</td>
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<tr>
<td>2/3</td>
<td>Runoff and streamflow hydrogeological framework of Long Island.</td>
<td>Chapter 2</td>
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<tr>
<td>2/10</td>
<td>Runoff and streamflow [PS#1].</td>
<td>Chapter 2</td>
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<tr>
<td>2/17</td>
<td>Porosity Specific yield, hydraulic conductivity</td>
<td>Chapter 3</td>
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<tr>
<td>2/24</td>
<td>Hydraulic conductivity (cont.) Aquifer characteristics, anisotropy and heterogeneity, compressibility and effective stress [PS#2].</td>
<td>Chapter 3</td>
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<tr>
<td>3/3</td>
<td>Fluid mechanics, force potential and hydraulic head, specific discharge and seepage velocity, Darcy's law</td>
<td>Chapter 4</td>
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<tr>
<td>3/10</td>
<td><strong>Mid-term examination</strong></td>
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<tr>
<td>3/17</td>
<td>Spring break</td>
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<tr>
<td>3/31</td>
<td>Introduction to numerical simulation techniques: finite difference and finite element methods</td>
<td>Chapter 13</td>
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<td>4/7</td>
<td>Transient flow, well hydraulics in confined aquifers</td>
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<td>4/14</td>
<td>Pumping tests in leaky aquifer and unconfined aquifer, slug test. Effect of hydrogeologic boundaries, pumping test design, use of MODFLOW (5.9 - 5.10). [PS. #4].</td>
<td>Chapter 5</td>
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<tr>
<td>4/28</td>
<td>Groundwater remediation, capture zone analysis (10.8 - 10.10). Groundwater development and management. Geology of groundwater occurrence, salt water</td>
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The University Senate Undergraduate and Graduate Councils have authorized that the following required statements appear in all teaching syllabi (graduate and undergraduate courses) on the Stony Brook Campus.

**Americans with Disabilities Act:**
If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

**Academic Integrity:**
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

**Critical Incident Management:**
Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.