GEOL614: Advanced Hydrogeology

Syllabus, Fall 2014

Instructor:
Dr. Hongbin Zhan, Professor and Holder of Endowed Ray C. Fish Professorship in Geology, Halbouty #259 (office), phone: 979-574-4819 (cell), 979-862-7961 (office), email: zhan@geos.tamu.edu, website: http://geoweb.tamu.edu/zhan/course/410f14/410f14all.html

Teaching Assistant:
Ms. Sakineh Arefi Fard, PhD student, Department of Geology and Geophysics, sarefifard@email.tamu.edu, office hours: Monday 10a.m.-12noon, Halbouty #166.

Textbook and/or Class Notes:
Fetter, C. W., Applied Hydrogeology, Merril Publishing Co., Columbus, OH, 592 pp., 4nd ed., 2001. Class notes are the primary study materials and will be published in the instructor's website.

Lecture Time and Location:
TR 3:55-5:10 p.m., Halbouty 104.

Instructor Office Hours:
3:00-5:00 p.m., Wednesday, in Halbouty #259 (my office).

Term paper and final team presentation
Each graduate student needs to prepare a term paper and the final presentation of the term paper (10 minutes). The term paper is submitted at the same deadline as the last homework assignment with a topic selected by the instructor at 2nd week of October (the graduate students are also welcome to propose potential topics to the instructor before the 2nd week of October).

Course Grading Policies:
There are two exams (Midterm and Final, see the schedules below) and a series of assignments, plus the term paper and the final presentation. The final exam is not comprehensive. It will only cover material since the midterm exam.

• homework assignments: 30 %;
• term paper (5%) and final presentation (5%): 10 %;
• midterm exam (October 16, Thursday, 3:55-5:10 p.m.): 30 %;
• final exam (December 16, Tuesday, 1-3 p.m.): 30 %.

Numerical grades on homework assignments, midterm exam and final exam will be rounded at the first decimal place (e.g. 89.50%→90%, 89.49%→89%). Letter grades for individual assignments will be computed as follows: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F <60%. No extra credit will be available.

Assignments can be accepted late no more than ONCE within one week of the due date, but the grade will be reduced 25% for that assignment. Assignments cannot be accepted one week after the due date.
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The last assignment cannot be accepted after the due date because the instructor has to grade and return the assignment to students for final preparation.

A student with an official medical, religious, and university excused absence (with adequate documents provided to the instructor) will not be counted as absent. Students should consult Student Rule 7 for attendance and excused absence.

Attendance: 100% (+0.5), 90-80% (+0.25), 70-60% (0), 50-40%(-0.25), 30-0%(-0.5).

Learning Outcomes or Course Objectives

Student will be able to do all of the following:

1) Use different concepts such as evaporation, infiltration, groundwater recharge, base flow to analyze hydrological cycle and surface-groundwater interaction.
2) Conduct quantitative calculation of base flow based on stream hydrographs.
3) Use three important physical parameters (porosity, hydraulic conductivity, and storativity) of aquifers to understand the groundwater flow systems.
4) Measure and calculate hydraulic head, elevation head, pressure head, and hydraulic gradient in the field.
5) Conduct calculation using Darcy’s law for a variety of problems such as computing discharge of water between two paralleled rivers, computing contaminant travel time from a source to a discharge point, and calculating groundwater flow in horizontal and vertical directions.
6) Interpret local, intermediate, and regional groundwater flows, and the law of refraction for groundwater flow at the interface of two media with different hydraulic conductivity values.
7) Derive the groundwater flow governing equation and applying the equation for practical boundary value problems (BVPs).
8) Apply the concept of effective stress and seepage force for geo-engineering problems such as landslide and slope failure, uplifting, erosion of landform, seismic activity after injecting fluid to deep formation, groundwater-surface water interaction during the flooding, and overthrust faulting aided by groundwater.
9) Calculate freshwater-seawater interface in coastal aquifers and islands.
10) Compute drawdowns near a pumping well using Theis solution and leaky Thesis solution.
11) Interpret different well testing results such as Pumping Test and Slug Test.
12) Calculate well capacity and well efficiency

Course Topics:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Required Reading</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrological Cycle; Management of groundwater</td>
<td>Fetter Chapter 1.3, 1.5</td>
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<tr>
<td>2</td>
<td>Porosity</td>
<td>Fetter Chapter 4.2</td>
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<tr>
<td>3</td>
<td>Groundwater potential and hydraulic head</td>
<td>Fetter Chapter 5.1-5.5</td>
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<td>4</td>
<td>Darcy’s law and hydraulic conductivity</td>
<td>Fetter Chapter 4.4</td>
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<td>5</td>
<td>Aquifers, aquitards, and aquicludes</td>
<td>Fetter Chapter 4.5, 4.7</td>
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<tr>
<td>Chapter</td>
<td>Topic</td>
<td>Notes</td>
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<td>6</td>
<td>Transmissivity and storativity of confined aquifers; Release of water from confined aquifers.</td>
<td>Fetter Chapter 4.10-11</td>
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<tr>
<td>7</td>
<td>Transmissivity and specific yield of unconfined aquifers.</td>
<td>Fetter Chapter 4.6, 4.8</td>
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<tr>
<td>8</td>
<td>Equations of groundwater flow; Analytical solutions of one-dimensional groundwater flow.</td>
<td>Fetter Chapter 5.7</td>
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<td>9</td>
<td>Groundwater flow patterns; Groundwater and geology (effective stress, groundwater flow and faulting).</td>
<td>Fetter Chapter 8.6, class notes</td>
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<tr>
<td>10</td>
<td>Land subsidence; Groundwater and geotechnical engineering; Flood control.</td>
<td>Class notes</td>
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<td>11</td>
<td>Sea water intrusion.</td>
<td>Fetter Chapter 9.7-9.8</td>
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<td>12</td>
<td>Steady-state flow to a well (the Thiem solution).</td>
<td>Fetter Chapter 7.4.2</td>
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<td>13</td>
<td>Transient flow to a well: the Theis method and pumping test.</td>
<td>Fetter Chapter 7.3</td>
</tr>
<tr>
<td>14</td>
<td>Transient flow to a well in leaky confined and unconfined aquifer and slug test.</td>
<td>Fetter Chapter 7.4.4</td>
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</tbody>
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**All students should pay attention to the following:**

**THE AMERICANS WITH DISABILITIES ACT (ADA):** If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.

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