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## Graduate Programs—NEW COURSE PROPOSAL

DEPARTMENT NAME: **GEOSCIENCES** COLLEGE OF: **SCIENCE**

**RECOMMENDED COURSE IDENTIFICATION:**  
 PREFIX GLY COURSE NUMBER 6109 LAB CODE (L or C) \_\_\_\_\_  
 \_\_\_\_\_  
 (TO OBTAIN A COURSE NUMBER, CONTACT ERUDOLPH@FAU.EDU)  
 COMPLETE COURSE TITLE  
**BENCHMARK DEVELOPMENTS IN HYDROGEOLOGY**

**EFFECTIVE DATE**  
 (first term course will be offered)  
 \_\_\_\_\_

**CREDITS:**  
 3

**TEXTBOOK INFORMATION:**  
 In keeping with the seminar format of this course, in lieu of a textbook students will be required to read a number of papers that focus on benchmark developments in the field of hydrogeology. Students will also be required to read biographies of influential hydrogeologists.

**GRADING (SELECT ONLY ONE GRADING OPTION):** REGULAR  PASS/FAIL \_\_\_\_\_ SATISFACTORY/UNSATISFACTORY \_\_\_\_\_

**COURSE DESCRIPTION, NO MORE THAN 3 LINES:**  
 This seminar examines changes in humans' understanding of groundwater through time beginning with ancient uses of groundwater, continuing through the present, and ending with projections about the future of hydrogeologic research. Students will solidify their knowledge of the fundamental principles of hydrogeology and will broaden their understanding of the history and philosophy of science.

**PREREQUISITES W/MINIMUM GRADE:\***  
 GLY4822, or permission of instructor

**COREQUISITES:**

**OTHER REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL):**

PREREQUISITES, COREQUISITES & REGISTRATION CONTROLS SHOWN ABOVE WILL BE ENFORCED FOR ALL COURSE SECTIONS.  
 \*DEFAULT MINIMUM GRADE IS D-.

**MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:**

Other departments, colleges that might be affected by the new course must be consulted. List entities that have been consulted and attach written comments from each. Civil Engineering

\_Tara Root, [troot@fau.edu](mailto:troot@fau.edu), 561-297-3253 \_\_\_\_\_  
 Faculty Contact, Email, Complete Phone Number

**SIGNATURES**

**SUPPORTING MATERIALS**

**Approved by:**  
 Department Chair: \_\_\_\_\_  
 College Curriculum Chair: \_\_\_\_\_  
 College Dean: \_\_\_\_\_  
 UGPC Chair: \_\_\_\_\_  
 Dean of the Graduate College: \_\_\_\_\_

**Date:**  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Syllabus**—must include all details as shown in the UGPC Guidelines.  
**Written Consent**—required from all departments affected.  
 Go to: <http://graduate.fau.edu/gpc/> to download this form and guidelines to fill out the form.

Email this form and syllabus to [diamond@fau.edu](mailto:diamond@fau.edu) and [eqirjo@fau.edu](mailto:eqirjo@fau.edu) one week **before** the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website by committee members prior to the meeting.

**Course name:** Benchmark Developments in Hydrogeology

**Course number:** GLY 6109

**Prerequisites:** GLY4822 – Hydrogeology, or permission of instructor

**Instructor:** Dr. Tara Root  
[troot@fau.edu](mailto:troot@fau.edu)  
(561)297-3253  
PS345

**Office hours:** To be announced

**Classroom:** To be announced

**Online course information:** You can access the Blackboard site for this course at <http://blackboard.fau.edu>. Login using your FAUNet ID.

**Required text:** In lieu of a textbook, students will be required to read a number of papers that focus on benchmark developments in the field of hydrogeology. Students will also be required to read biographies of influential hydrogeologists. See below for a list of these papers.

- Anderson, M.P., 1989. C.V. Theis and Heterogeneity in Recent Advances *in* Ground-Water Hydrology, First C.V. Theis Symposium: American Institute of Hydrology, pp. xix-xxi.
- Back, W.B., 1987. Introduction to *The History of Hydrology*. History of Geophysics, Volume 3. Landa, E.R. and Ince, S., eds. American Geophysical Union.
- Back, W.B., 1996. T.C. Chamberlin, Early American Hydrogeologist. *Hydrogeology Journal*, 4:2, 94-95.
- Back, W.B. and Herman, 1997. American Hydrogeology at the Millenium: An Annotated Chronology of the 100 Most Influential Papers. *Hydrogeology Journal*, 5:4, 37-50.
- Biswas, 1970. History of Hydrology. North Holland Publishing Company, Amsterdam. pp. 26-29, 55-58, 61-68.
- Brown, G.O., 2002. Henry Darcy and the Making of a Law. *Water Resources Research*, 38:7, 11-1 – 11-12.
- Darton, N.H., 1897. Preliminary Report on Artesian Waters of a Portion of the Dakotas. U.S. Geological Survey 17<sup>th</sup> Annual Report, 609-617.
- Davis, 2007. Early American Doctors Who Studied Ground Water. *Ground Water*, 45:4, pp. 519 - 522.
- Demming, 2002. Introduction to Hydrogeology. McGraw Hill. pp. 98-99, 205-206, 318-324.

- Fetter, 2004. Hydrogeology: A Short History, Part 1. *Ground Water*, 42:5, 790-792.
- Freeze, R.A., 1994. Henry Darcy and the Fountains of Dijon. *Ground Water*, 32:1, 23-30.
- Freeze, R.A. and Back, W.B., 1983. Historical Perspective in Benchmark Papers in Geology: Hydrogeology. Vol. 72. pp. 3-4.
- Fryer, 2007. The Future of Hydrogeology, Then and Now: A Look Back at O.E. Meinzer's Perspectives, 1934 to 1947. *Ground Water*, 45:2, pp. 246-249.
- Galloway, 2010. The Complex Future of Hydrogeology. *Hydrogeology Journal*, 18, pp. 807 - 810.
- Hallam, 1989. Great Geological Controversies, 2<sup>nd</sup> Edition. Oxford Science Publications. pp. 223-225.
- Howard, 2005. Albert Einstein as a Philosopher of Science. *Physics Today*, 58:12. 34-40.
- Lohman, S.W., 1986a. Tribute to Oscar Edward Meinzer in Two-Hundred Years of Hydrogeology in the United States, Rosenshein et al., eds. U.S. Geological Survey Open File Report 8-480.
- Lohman, S.W., 1986b. The Quantification of Hydrogeology in Two-Hundred Years of Hydrogeology in the United States, Rosenshein et al., eds. U.S. Geological Survey Open File Report 8-480.
- Maxey, G.B., 1986. The Meinzer Era of Hydrogeology in the United States, 1910 – 1940 in Two-Hundred Years of Hydrogeology in the United States, Rosenshein et al., eds. U.S. Geological Survey Open File Report 8-480.
- Meinzer, O.E., 1928. Compressibility and Elasticity of Artesian Aquifers, *Economic Geology*, 23 263-277.
- Meyer, G.B., 1986. Scientific Advances in Two-Hundred Years of Hydrogeology in the United States, Rosenshein et al., eds. U.S. Geological Survey Open File Report 86-480.
- Narasimhan, 2005. Hydrogeology in North America: Past and Future. *Hydrogeology Journal*, 13:1, pp. 7-24.
- Parker, G.G., 1986. Early Stage of Hydrogeology in the United States in Two-Hundred Years of Hydrogeology in the United States, Rosenshein et al., eds. U.S. Geological Survey Open File Report 86-480.
- Reilly, 2004. A Brief History of Contributions to Ground Water Hydrology by the U. S. Geological Survey. *Ground Water*, 42:4, 625-631.
- Slichter, C.S., 1899. Theoretical Investigation of the Motion of Ground Waters. U.S. Geological Survey 19<sup>th</sup> Annual Report, Part 2.

Toth, J. 2002. Jozsef Toth: An Autobiographical Sketch. *Ground Water* 40:3, 320-324.

White and Clebsch, 1994. C.V. Theis, The Man and His Contributions to Hydrogeology in Selected Contributions to Ground-Water Hydrology by C.V. Theis, and a Review of His Life and Work, U.S. Geological Survey Water Supply Paper 2415.

Wang, H.F. 1987. Charles Sumner Slichter – An Engineer in Mathematician's Clothing in *The History of Hydrology*. History of Geophysics, Volume 3. Landa, E.R. and Ince, S., eds. American Geophysical Union, pp. 103-112.

### **Bibliography:**

Back, W.B., 1987. *The History of Hydrology*. History of Geophysics, Volume 3. Landa, E.R. and Ince, S., eds. American Geophysical Union.

Back, W.B. and Herman, 1997. American Hydrogeology at the Millenium: An Annotated Chronology of the 100 Most Influential Papers. *Hydrogeology Journal*, 5:4, 37-50.

Belitz, 2001, Ground Water is Alive and Well - It Just Keeps Shifting, *Ground Water*, Vol. 39, No. 4, p. 481.

Biswas, 1970. History of Hydrology. North Holland Publishing Company, Amsterdam.

Davis, 2007. Early American Doctors Who Studied Ground Water. *Ground Water*, 45:4, pp. 519 - 522.

Davis and Augusta, 2005. Hydrogeology in the United States 1780 – 1950. University of Arizona Department of Hydrology and Water Resources Technical Report HWR 05-020.

Fetter, 2004. Hydrogeology: A Short History, Part 1. *Ground Water*, 42:5, 790-792.

Fryer, 2007. The Future of Hydrogeology, Then and Now: A Look Back at O.E. Meinzer's Perspectives, 1934 to 1947. *Ground Water*, 45:2, pp. 246-249.

Galloway, 2010. The Complex Future of Hydrogeology. *Hydrogeology Journal*, 18, pp. 807 - 810.

IAHS, 2008. Benchmark Papers in Hydrology, Vol. 3, Anderson, M.P. ed. International Association of Hydrological Sciences.

Miller and Gray, 2002, Hydrogeological Research: Just Getting Started, *Ground Water*, Vol. 40, No. 3, 224-231.

Narasimhan, 2005. Hydrogeology in North America: Past and Future. *Hydrogeology Journal*, 13:1, pp. 7-24.

Phillips, F.M., 2002, Hydrogeology: Time for a New Beginning?, *Ground Water*, Vol. 40, No. 3, p. 217.

Reilly, 2004. A Brief History of Contributions to Ground Water Hydrology by the U. S. Geological Survey. *Ground Water*, 42:4, 625-631.

Schwartz and Ibaraki, 2001, Hydrogeological Research: Beginning of the End or End of the Beginning?, *Ground Water*, Vol. 39, No. 4, pp. 492-498.

USGS, 1986. Two-Hundred Years of Hydrogeology in the United States, Rosenshein et al., eds. U.S. Geological Survey Open File Report 8-480.

**Course description and instructional objectives:** This seminar examines changes in humans' understanding of groundwater through time beginning with ancient uses of groundwater, continuing through the present, and ending with projections about the future of hydrogeologic research. Students will solidify their knowledge of the fundamental principles of hydrogeology and will broaden their understanding of the history and philosophy of science.

By the end of this course, students should be able to

- 1) articulate how changing social contexts have shaped the progress of hydrogeology
- 2) identify key historical hydrogeologic advancements and describe the fundamental scientific principles that are components of those advancements
- 3) clearly articulate their individual opinion about the definition of science and begin developing their personal philosophy of science

**Method of instruction:** The instructor will present a short review of relevant scientific principles at the beginning of each meeting. Following this introduction, we will hold a seminar style discussion about the week's readings. Each student will be responsible for leading the class discussion 2 or 3 times during the semester. The class leader will upload a list of questions related to the week's readings to Blackboard at least three days prior to that week's class meeting. All students are expected to read the papers and reflect on the questions provided by the class leader prior to class. The questions are intended to help focus and guide the course discussion.

Students will be required to record their reflections about the course discussions in a notebook. The notebooks will be collected and graded periodically throughout the semester. Notebook grades will be based primarily on the student's depth of thought. Student's that only take notes about what was said in class will earn a relatively low grade; whereas students that note what they found most interesting about the discussion, reflect on how the discussion may have influenced their understanding, and pose questions that go beyond what was specifically discussed in class will earn a relatively high notebook grade.

Students will also be required to do individual research on some historical aspect of hydrogeology and present their findings in a poster presentation. A conference-style poster session will be held during the final class meeting.

## Schedule including topics covered:

Week	Topic
1	Course intro and intro to philosophy of science
2	Philosophy of science
3	Ancient views of ground water
4	Early advancements in quantitative hydrology
5	Darcy
6	Overarching view of "modern" hydrogeology
7	Early U.S. Hydrogeology - Chamberlin
8	Early U.S. Hydrogeology - Darton
9	Early U.S. Hydrogeology - Slichter
10	The Meinzer Era of Hydrogeology - Meinzer
11	The Meinzer Era of Hydrogeology - Theis
12	The Modern Era of Hydrogeology - Hubbert and Toth
13	The Modern Era of Hydrogeology - Numerical models
14	Hydrogeochemistry
15	The future of Hydrogeology
16	Poster presentations

## Assessment procedure:

Graded components of the course include

- 1) Class participation: 100 points (points assigned at end of semester by instructor)
- 2) Student notebooks: 50 points for the 1<sup>st</sup> half of the semester and 50 points for the last half of the semester (students hand in their notebooks in Week 7 and again in Week 16)
- 3) Leading of discussions: 50 points per discussion (students generally lead 2 discussions per semester)
- 4) Final poster: 100 points (Week 16)

**Policy on make-up work:** Class leaders are required to post their questions on Blackboard at least three days prior to class – **no exceptions** without documented evidence of a medical or family emergency. Students must have their posters ready to present on the last day of class – **no exceptions** without documented evidence of a medical or family emergency. Unless arrangements have been made with me **prior to the due date**, the score on all notebooks will be decreased by 20% for every day beyond the due date. Notebooks turned in more than 5 days late will receive a score of zero.

## Grading criteria:

Total points possible: 400

Letter grades will be assigned as follows:

A	372-400	C	292-308
A-	360-372	C-	280-292
B+	348-360	D+	268-280
B	332-348	D	252-268
B-	320-332	D-	240-252
C+	308-320	F	less than 240

**Extra credit:** No extra credit will be given.

**University “Students with disabilities” policy:** In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute course work must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

**University “Honor code” statement:** Students at Florida Atlantic University are expected to maintain the highest ethical standards. Dishonesty is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. For further details see [http://www.fau.edu/regulations/chapter4/4.001\\_Code\\_of\\_Academic\\_Integrity.pdf](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf), last accessed 10/8/10.



**From:** Pete Scarlatos (pscarlat@fau.edu)  
**To:** troot@fau.edu;  
**Date:** Mon, September 20, 2010 10:10:52 AM  
**Cc:** ivy@fau.edu; croberts@fau.edu;  
**Subject:** RE: New course proposals

Dr. Root,

After consultation with the CEGE faculty members, there is no conflict between our courses and those that you propose.

Good Luck,

*Pete S.*

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*Dr. Panagiotis (Pete) D. Scarlatos, Chair & Professor*  
*Department of Civil, Environmental and Geomatics Engineering (CEGE)*  
*College of Engineering and Computer Science*  
*Florida Atlantic University*  
*777 Glades Road, Engineering West (Bldg EG-36), Room 204*  
*Boca Raton, Florida 33431-0991*  
*Tel: 561-297-0466 (Office)*  
*Tel: 561-699-2579 (i-phone)*  
*Fax: 561-297-0493*  
*E-mail: pscarlat@fau.edu*  
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**From:** Tara Root [mailto:troot@fau.edu]  
**Sent:** Friday, September 17, 2010 3:47 PM  
**To:** scarlatos@civil.fau.edu  
**Cc:** Russ Ivy; Charles Roberts  
**Subject:** New course proposals

Dr. Scarlatos,

I am going through the process of getting two new hydrogeology-related courses approved by the university. Since your department has some hydro-related interests, I thought I should check with you about any potential conflicts. The syllabi for the two courses, Benchmark Developments in Hydrogeology and Methods in Hydrogeology, are attached. Please let me know if your department has any conflicts with us offering these courses. And, if there are no conflicts, would you please send me an e-mail to that effect, which I can include with the course approval paperwork?

Thanks,  
Tara

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