

GEO345: Water Resources

Course Information and Syllabus, Spring 2018

Schedule: TR, 11:00 am to 12:20 pm
Location: 355 Fillmore
Email: seanb@buffalo.edu

Instructor: Dr. Sean J. Bennett
Office: 126 Wilkeson Quad
Office Hours: TR 12:30 to 2:00 pm

Course Description: Water and water resources are critical issues for the sustenance of nearly every society. This course examines the occurrence, use, management, and conservation of water and water resources in the U.S. and around the world. It further discusses the environmental, economic, and social implications of floods, droughts, dams, and water usage as well as current issues in water quality, water pollution, and water resource regulation. Students will gain an understanding of the environmental, societal, and political impacts of water, water resources, and changes in water supply and availability, and they will be introduced to current and emerging trends in water resource issues, development, and technology.

Learning Outcomes

Number	Program Learning Outcome	Depth*	Specific outcome objectives for GEO345	Assessment instrument
1	Provide breadth of knowledge of basic principles and concepts	2	Provide a broad background on the occurrence, use, management, and conservation of water and water resources in the U.S. and around the world	Exams 1 to 3
2	Provide depth within specialized areas	2	Understand physical hydrology and the hydrologic basis of water resources	Exam 1
			Explore water supply and demand, irrigation and agriculture, water allocation law and policy, and flood hazards and hydrology	Exam 2
			Examine dams and reservoirs, drought, water geochemistry, water quality and pollutants, and the economic and political aspects of water resources	Exam 3
3	Provide an understanding of experimental/research design and methodology	2	The scientific method will be presented and consistently applied for all topics discussed	N/A
4	Develop approaches for integration of information	2	The course will address four major milestones (simplified water budget, the geography of water supply and demand in the US, water resource development, and water quality and health), which requires integration of many related concepts and principles	Exams 1 to 3
5	Encourage critical thinking and hypothesis building	2	Critically examine the role government policy plays in the environment, specifically with regard to water resource development, formulation of water allocation law, and the tenets of the Clean Water Act	Exams 2 and 3
6	Provide skills in writing and communication	0		N/A
7	Provide contemporary information	2	Present and discuss relevant topics in real-time (e.g., weather phenomena, floods, pollution issues, natural disasters) using information available through the media	Media discussions, video presentations
			Present case studies of local interest (e.g., Buffalo Water Authority, NY Power Authority) as it relates to course material	Media discussions, video presentations
8	Encourage appreciation of scientific values	2	Apply the basic principles of hydrologic science, physics, agricultural engineering, and chemistry to the understanding of water resources and socioeconomic development	Exams 1 to 3

*Depth: 0 - not covered; 1 - moderately covered; 2 - extensively covered

Course Syllabus, Suggested Readings, and Assessment Schedule

Date	Topic No.	Topic	Suggested Readings		
			Hornberger et al.	Jones	Thompson
<i>Part 1: Hydrologic Basis of Water Resources</i>					
1/30	1	General Concepts in Hydrology	1	1	1
2/1	2	Global Hydrologic Cycle	1	2	1
2/6	3	Precipitation	2	2, 5	1
2/8	4	Evapotranspiration	2	3, 5	1
2/13	5	Infiltration and Runoff I	8	3	1
2/15	6	Infiltration and Runoff II	9	3, 6	1
2/20	7	Streamflow and Watersheds I	3, 4, 5	6	1
2/22	8	Streamflow and Watersheds II	3, 4, 5	6	1
2/27		EXAM 1: Topics 1 to 8			
3/1	9	Groundwater	6, 7	3	1
<i>Part 2: Water Resource Usage and Issues</i>					
3/6	10	Water Supply and Demand in the U.S.		1, 2	2, 4
3/8	11	Water Supply and Demand: LA, NYC, Buffalo		1, 2	2, 4
3/13	12	Irrigation and Agriculture		7	7
3/15	13	Water Allocation Law in the U.S.			3
<i>Part 3: Water and Society</i>					
3/20		NO CLASS			
3/22		NO CLASS			
3/27	14	Flood Hazards and Hydrology	5	4	10
3/29	15	1993 Flood of the Mississippi River		4	10
4/3	16	Flood Hazard Planning and Protection		4, 10	10
4/5	17	Dams and Reservoirs I		7, 9	6, 8
4/10		EXAM 2: Topics 9 to 17			
4/12	18	Dams and Reservoirs II		7, 9	6, 8
4/17	19	Drought		4, 10	10
<i>Part 4: Water Quality and Resource Management</i>					
4/19	20	Geochemistry of Fresh Water		8	9
4/24	21	Water Quality and Pollutants I		8	9
4/26	22	Water Quality and Pollutants II		8	9
5/1	23	Water Quality and Pollutants III		8	9
5/3	24	Water Quality and Pollutants IV		8	9
5/8	25	Water Resources and Economic Development		11	5
5/10	26	Water Resources and Politics		11	
5/15	EXAM 3: Topics 18 to 26, 11:45 am to 2:45 pm in 355 Fillmore (plus all make-up exams)				

Required Text: Because no appropriately written and priced book currently is available, there is no required textbook.

Recommended Texts: I very strongly suggest students obtain used/rented/electronic copies of these textbooks to supplement the lecture material.

- G.M. Hornberger, J.P. Raffensperger, P.L. Wiberg, and K.N. Eshleman, *Elements of Physical Hydrology*, The Johns Hopkins University Press, Baltimore, 312 pp., 1998 (ISBN: 9780801858574). N.B. The newest addition is also acceptable: G.M. Hornberger, P.L. Wiberg, J.P. Raffensperger, and Paolo D'Odorico, *Elements of Physical Hydrology, 2nd Ed.*, The Johns Hopkins University Press, Baltimore, 392 pages, 2014 (ISBN: 9781421413730).
- J.A.A. Jones, *Global Hydrology: Processes, Resources, and Environmental Management*, Prentice Hall, New York, 399 pp., 1998 (ISBN: 9780582098619).
- S.A. Thompson, *Water Use, Management, and Planning in the United States*, Academic Press, San Diego, 371 pp., 1999 (ISBN: 9780126893403).

Additional Literature: Supplemental lecture material shall be derived from the following books.
 S.L. Dingman, *Physical Hydrology*, 2nd edition, Prentice-Hall, Inc., New Jersey, 646 pp., 2002.
 T. Dunne and L.B. Leopold, *Water in Environmental Planning*, W.H. Freeman & Co., New York, 818 pp., 1978.
 P.H. Gleick, editor, *Water in Crisis: A Guide to the World's Fresh Water Resources*, Oxford University Press, New York, pp. 1-113, 1993.
 Holden, J., editor, *Water Resources: An Integrated Approach*, Routledge, Oxon, 400 pp., 2013.

Resources: All recommended textbooks will be made available at the Undergraduate Library Reference Desk, Capen Hall, for two-hour, in-house use. All graphics shown in class, as well as a lecture outline, exam questions, and announcements, will be posted on *UBlearns* in PDF format prior to lectures.

Assessment: Students will be required to complete three (3) equally-weighted essay exams. For each lecture, one (1) to two (2) essay questions will be distributed to the class every week via *UBlearns*. For each exam, twelve (12) essay questions would be distributed. From these twelve (12) questions, six (6) will appear on the exam, and each student shall be required to answer four (4) of the six (6) questions.

Make-up Exams: Any student missing an exam will be required to take a make-up exam. If a student can provide written documentation of severe illness or other extenuating circumstance from a medical doctor or similar professional, s/he shall write a make-up exam comprised of essay questions as described above (“Excused Make-up”); six (6) of the twelve (12) questions will appear on the exam, and each student shall be required to answer four (4) questions of these six (6). All others shall write an exam comprised of four (4) essay questions chosen by the Instructor rather than chosen by the student (“Unexcused Make-up”). The Instructor reserves the right to refuse any and all documentation of illness or circumstance.

The third exam for the semester (Exam 3) shall be administered on Tuesday, May 15 from 11:45 am to 2:45 pm in 355 Fillmore, a time designated during finals week. All make-up exams will be administered immediately after the conclusion of Exam 3. No exceptions to this date will be given. Failure to take a make-up exam on the prescribed date will result in a “0” grade. All responsibility for make-up exams resides with the student.

Classroom Policies: I shall follow and strictly enforce the *Obstruction or Disruption in the Classroom* policies as described in the Undergraduate Catalog (see <https://catalog.buffalo.edu/policies/obstruction.html>). The use of electronic devices in the classroom (computers, tablets, PDAs, cellular phones, etc.) will not be allowed.

Academic Integrity: All students should read and adhere to UB’s Academic Integrity Policies and Procedures, <https://catalog.buffalo.edu/policies/integrity.html>.

Grades: Below is a table that lists University letter grades (last column) and the equivalent percentages I will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to increase the scores of all students for any exam or the cumulative average, if necessary. No work for extra credit shall be given. An “Incomplete” grade will not be given to students who have missed exams.

Grading Matrix:

Numerical value		Equivalent University letter grade
greater than or equal to (%)	and less than (%)	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
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