1 Instructor and Course Information

Advanced Academic Programs
Zanvyl Kreiger School of Arts and Sciences
Johns Hopkins University

Syllabus
Hydrology and Water Resources
420.604.81

Instructor Information

Instructor:	Dr. Christiane 'Chrissy' Runyan
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Office Hours:	Email me to schedule a 'chat' session. Otherwise you can contact me directly by email.

Course Description

This course provides an introduction to the hydrological cycle and examines the influence of climate, geology, and human activity on this cycle. The components comprising this cycle will be examined and include: precipitation; evapotranspiration; surface and groundwater flow; storage in natural reservoirs; water quality; and water resource management and regulation. Discussion of these topics in threaded discussions as well as problem sets using the primary literature will highlight applications and areas of current hydrological research.

Course Objectives

Following the completion of this course, students should understand the key processes in the hydrologic cycle and different factors driving a change in these processes. They should also have a broad understanding of how these processes are connected. Lastly, they should understand how to assess water quality and quantity issues and tools available to address these issues.

Course Prerequisites

Prior to taking this course, students need to have completed their quantitative requirements for this program, specifically Quantitative Methods for Environmental Sciences or at a minimum one semester of undergraduate Calculus. Weekly problem sets/quizzes as well as the midterm and final will require quantitative problem solving skills and sometimes entail working with small datasets.

2 Course Materials

Textbook

Ward, A.D. and S. W. Trimble, Environmental Hydrology (3e), Lewis Publishers, Boca Raton, Fl, 2015.

- The textbook can be purchased on Amazon, Barnes and Noble, the JHU bookstore and most internet textbook stores.

Other readings

Other readings will be posted in the weekly content for the course when relevant.

Other software

It is helpful for this course, if you are familiar with Microsoft Excel or some other graphing program.

3 Assessments and Grading Policy

Course Basics

Each unit will open on a Wednesday at 12:00 am and will close Tuesday of the following week at 11:59 pm. Apart from the midterm, student presentation and final weeks, students are expected to participate in threaded discussions and complete a problem set or quiz each week.

Assignments

A weekly problem set or quiz will be assigned (with the exception of the weeks where we have the midterm, the final and the weeks where your projects are due and presented). Problem sets/Quizzes will be due prior to the close of the unit, which occurs on Tuesday at 11:59 pm EST. With the exception of emergency situations, late homeworks will be penalized at 5% per day. In addition, each student will be expected to contribute two posts (see below for the grading policy) to the weekly threaded discussions (with the exception being test weeks). The midterm and final will incorporate material from these problem sets and key concepts presented during lecture. As a 'field trip', you will do a group report on your watershed that you and your group will 'present' to your classmates during the second to last week of class. Please refer to the table below for due dates.

Grading

Problem Sets	(10@ 5 points each)= 50 points
Threaded Discussion Participation	(10@ 5 points each)= 50 points
Midterm	30 points
Final	30 points
'Field Trip' Report and Presentation	40 points

Threaded discussion grades

Each student is expected to post at least twice to the weekly thread. One post should present an idea that is new to the thread, and the other post should be in response to a post made by another student. For weeks when there is more than one threaded discussion topic, you are free to choose which topic you would like to respond to. Each week's threaded discussion will be graded on a 0-5 point scale, which is described as follows,

4-5 points: Contributes in a timely, thoughtful, concise, and relevant manner. Includes references from the outside literature and/or lecture. Makes their first post by **Saturday** at midnight following the opening of the unit.
3-4 points: Contributes to the discussion, but needs improvement in one of the categories listed above.
2-3 points: Contributes to the discussion in a limited, infrequent, or poorly thought out manner.
0-2 points: Makes minimal or no contribution to the discussion; comments are irrelevant or insignificant.

Final grades

Final grades will be assigned based on the following scale:

A+ 98-100%
A 93-97%
A- 90-92%
B+ 87-89%
B 83-86%
B- 80-82%
C 70-79%
F <70%

4 Course Communication Policy

Contacting the Instructor

Please feel free to contact me, preferably by email with any questions that you may have. I will try my best to respond to you within 24-36 hours; however, it could be a little longer if I am travelling or busy with a work deadline. Also, I suggest that if you have a question relating to the course material, that you post the question under the thread group Syllabus so that classmates might be able to assist you.

It is important that you regularly check your JHU email address or forward your JHU email to a different email address that you frequently use. Also, please make sure that all of your communications for this course are sent through your JHU email address.

Getting Help

You have a variety of methods to get help on Blackboard. Please consult the help resources listed in the online classroom for additional information. Important Note: If you encounter technical difficulty in completing or submitting any online assessment, immediately contact the 24-hour Help Desk listed under the "Blackboard Help" tab. Also, contact your instructor at the email address listed atop this syllabus.

5 University Policies

General

This course adheres to all University policies described in the academic catalog. Please pay close attention to the following policies:

Students with Disabilities

Johns Hopkins University is committed to providing reasonable and appropriate accommodations to students with disabilities. Students with documented disabilities should contact the coordinator listed on the Disability Accommodations page. Further information and a link to the Student Request for Accommodation form can also be found on the Disability Accommodations page.

Ethics & Plagiarism

JHU Ethics Statement: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.
Read and adhere to JHU's Notice on Plagiarism.

During this course, you will have the option to complete a short course about plagiarism for extra credit. An announcement will be made during the first week.

Dropping the Course

You are responsible for understanding the university's policies and procedures regarding withdrawing from courses found in the current catalog. You should be aware of the current deadlines according to the Academic Calendar.

Getting Help

You have a variety of methods to get help on Blackboard. Please consult the resource listed in the "Blackboard Help" link for important information. If you encounter technical difficulty in completing or submitting any online assessment, please immediately contact the designated help desk listed on the AAP online support page. Also, contact your instructor at the email address listed in the syllabus.

Copyright Policy

You have a variety of methods to get help on Blackboard. Please consult the resource listed in the "Blackboard Help" link for important information. If you encounter technical difficulty in completing or submitting any online assessment, please immediately contact the designated help desk listed on the AAP online

support page. Also, contact your instructor at the email address listed in the syllabus.

Code of Conduct

To better support all students, the Johns Hopkins University non-academic Student Conduct Code has been integrated and updated to include all divisions of the University. In addition, it is important to note that all AAP students are still accountable for the Code of Conduct for Advanced Academic Programs.

6 Course Topics, Activities, Schedule and Objectives

Tentative Course Schedule

Important Note: *With the exception of weeks 6, and 12-14, the activity for each week will include lecture and an assigned reading as well as participation in the threaded discussions. There will also be a weekly problem set or quiz related to the material discussed during lecture.* ***This schedule is subject to change with sufficient notice and will be announced accordingly.***

Week	Dates	Topics	Activities	Assessments & Due Dates
1	09/05/18-09/11/18	Hydrologic Cycle	Threads; Read Ch. 1 and Lecture 1; Extra Credit	HW 1 Due: 09/11/18
2	09/12/18-09/18/18	Precipitation	Threads; Read Ch. 2 and Lecture 2	Quiz 1 Due: 09/18/18
3	09/19/18-09/25/18	Infiltration	Threads; Read Ch. 3 and Lecture 3	HW 2 Due: 09/25/18
4	09/26/18-10/02/18	Evapotranspiration	Threads; Read Ch. 4 and Lecture 4	Quiz 2 Due: 10/02/18
5	10/03/18-10/09/18	Runoff	Threads; Read Ch. 5 and Lecture 5	Quiz 3 Due: 10/09/18
6	10/10/18-10/16/18	Review	Midterm Exam	MIDTERM DUE: 10/16/18
7	10/17/18-10/23/18	Erosion	Threads; Read Ch. 6 and 9 and Lecture 6	Quiz 4 Due: 10/23/18
8	10/24/18-10/30/18	Channel Flow	Threads; Read Ch. 7 and 8.1-8.2 and Lecture 7	HW 3 Due: 10/30/18
9	10/31/18-11/06/18	Groundwater	Threads; Read Ch. 11 and Lecture 8	HW 4 Due: 11/06/18
10	11/07/18-11/13/18	Policy	Threads; Read Chap. 12.1-12.6 and Lecture 9	Quiz 5 Due: 11/13/18
11	11/14/18-11/20/18	Hydrologic impacts of land use change	Threads; Read Lecture 10; Assigned	HW 5 Due: 11/20/18

12	**11/21/18-11/27/18**	**Thanksgiving Break!**	**Relax!**	
13	**11/28/18-12/04/18**	**Conducting a hydrologic study**	**Chap. 14.1-14.9**	**Student Presentations: 12/03/18 Student Project: 12/04/18**
14	**12/05/18-12/11/18**	**Student Presentation and Discussions**	**Threads and Lecture 14**	
15	**12/12/18-12/18/18**	**Semester Review**	**Final Exam**	**FINAL DUE: 12/18/18**

Course Goals & Learning Objectives

Unit 1

- Students will know the key components of the hydrologic cycle.
- Students will understand how differences in the amount of energy received as a function of latitude contribute to general patterns of circulation.
- Students will understand the major components of the energy budget.
- Students will understand the concept of residence time.
- Students will understand the concept of steady state.
- Students will be able to identify large-scale factors contributing to observed temporal patterns and spatial trends in the global hydrologic cycle.

Unit 2

- Students will know the key 'ingredients' required for precipitation to occur.
- Students will know the different processes that cause a parcel of air to rise and cool.
- Students will understand how to calculate the return period and probability of occurrence for a given series of precipitation data.
- Students will be able to identify spatially, where different processes that cause a parcel to rise and cool might dominate.
- Students will be familiar with different types of precipitation gauges.
- Students will be familiar with several methods to obtain an areal estimate of precipitation.

Unit 3

- Students will be able to use the grain size distribution curve to determine soil texture.
- Students will know why the moisture characteristic curve and the hydraulic conductivity differ as a function of soil water content.

- Students will understand how properties of a soil such as porosity and bulk density differ between soil textures and why finer soils tend to have higher porosities than coarser soils.
- Students will understand how to calculate soil water storage terms such as volumetric water content and saturation.
- Students will understand the concept of hysteresis and how this affects the relationship between pressure head and moisture content.
- Students will be familiar with different methods to determine bulk density.
- Students will be familiar with different factors affecting the infiltration rate.
- Students will be familiar with Darcy's Law.
- Students will be familiar conceptually with different models that are available to model infiltration.

Unit 4

- Students will know what the important factors are in the process of evaporation.
- Students will understand how Dalton's Law and Fick's First Law of diffusion relate to evapotranspiration.
- Students will understand why the rate of evaporation is proportional to the concentration gradient of water vapor.
- Students will understand key factors affecting the transpiration rate.
- Students will understand how pressure gradients drive water movement through a plant.
- Students will understand the difference between Potential and Actual Evapotranspiration and where there is a large difference between these two terms.

Unit 5

- Students will know what a hydrograph is and key terms that are used to describe a hydrograph.
- Students will understand basic characteristics that affect the shape of a hydrograph.
- Students will be familiar with the relationship between gage height and discharge.
- Students will understand how temporal and spatial characteristics of the precipitation event affect stream response to that event
- Students will understand how basin characteristics such as soil moisture and soil type affect stream response
- Students will be familiar with the different mechanisms producing runoff including the difference between Hortonian overland flow and saturation overland flow.
- Students will understand how to use the SCS method to compute runoff and the rational method to estimate peak runoff.
- Students will be familiar with the unit hydrograph method to understand the response of a watershed to a precipitation event.

Unit 7

- Students will understand the different types of erosion
- Students will know the key factors affecting erosion losses
- Students will understand how to apply the universal soil loss equation and will understand the variables that comprise this equation
- Students will understand how to calculate sediment yield from a single storm event
- Students will be familiar with processes contributing to a meandering versus braided stream channel.
- Students will be familiar with terms that describe the stability of a stream
- Students will understand how channel modifications can alter discharge and patterns of aggradation/degradation.

Unit 8

- Students will be familiar with steady, unsteady, uniform and non-uniform flow.
- Students will understand the general flow equation
- Students will understand how to use Manning's Equation to estimate discharge and how to select an appropriate value of n.
- Students will understand how to use the Darcy-Weisbach equation to estimate discharge.
- Students will understand the difference between critical, subcritical and supercritical flows
- Students will understand what the Froude number tells them about the flow regime

Unit 9

- Students will understand how to use Darcy's Law to estimate groundwater flow rates
- Students will be familiar with the different types of aquifers
- Students will understand factors that influence groundwater flow patterns and residence times
- Students will understand how topography might influence the development of regional versus local groundwater flow patterns
- Students will understand how stream types differ depending on the position of the stream relative to that of the groundwater table
- Students will know the different inputs and outputs for a groundwater mass balance budget
- Students will be familiar with the concept of safe yield.

Unit 10

- Students will understand how to create a flow duration curve

- Students will understand what a flow duration curve might tell them about characteristics of the watershed
- Students will understand the different types of water resource shortages
- Students will know the different types of water resource uses and the difference between consumptive and non-consumptive use
- Students will understand how to analyze low and high flow and the variability surrounding these terms
- Students will be familiar with different types of drought

Unit 11

- Students will understand the concept of resilience and how this applies to the concept of land use change
- Students will be familiar with the concept of a positive feedback
- Students will be familiar with the concept of stable states and bistability
- Students will understand the controls of vegetation on key hydrologic processes
- Students will understand how deforestation can affect different aspects of the hydrologic cycle

Unit 13

- Students will understand the essential components to conducting a hydrologic study
- Students will know how to write a technical report for their hydrologic study
- Students will be able to find precipitation data for a station close to them and interpret this data by plotting it graphically
- Students will be able to find streamflow data, graph this data and calculate annual discharge from their streamflow data.
- Students will be able to estimate actual ET using the water balance equation
- Students will be able to find data to create a flow duration curve from a gaging station that is close to them