

NRSM 385 Watershed Hydrology

Instructor:

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Teaching assistant:

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Course Time & Location:

T/R 8:00 – 9:20
LA 11 and Online (Zoom)

Office Hours:

Jencso: Mon. 12:00 – 1:00
White: To be determined

Course Description: This course provides an introduction to watershed hydrology. We examine how rainfall and snowmelt become streamflow, evapotranspiration, and groundwater with an emphasis on the hydrological processes in Western U.S. watersheds. Topical areas include: the hydrologic cycle and water balances, evapotranspiration and snow energy balances, vadose zone hydrology, hydrogeology, hyporheic zones, riparian zones, streamflow generation mechanisms, biogeochemical budgets, and field measurement techniques. Watershed hydrology is by nature an interdisciplinary science and linkages between physical hydrology and broader ecological and environmental sciences will be highlighted. **Mathematical analysis and writing assignments will be an integral part of this course.**

Learning Outcomes: This course will introduce students to basic and emerging concepts in watershed hydrology. Students will obtain an understanding of: 1) the importance of water as a resource, both from a human perspective and in terms of its importance in the natural environment; 2) the water cycle, including the magnitude of the various above and below ground fluxes and storage; 3) the hydrologic processes that make up the water cycle, including precipitation, snowmelt, evapotranspiration, infiltration, percolation, groundwater recharge, discharge, and streamflow; 4) human impacts on water quantity and quality including effects of climate change, land use activities such as forest harvest, road construction, urban development, and natural disturbance events such as wildfire.

Grading:

- 1) Problem sets (40%)
- 2) 3 Exams (50%)
- 3) Quizzes and participation (10%)

The midterm exams will test your knowledge of material covered in class up to that point. All students must practice academic honesty.

Course Text:

Text: Elements of Physical Hydrology by George Hornberger (2rd edition).

Additional Reading: Principles of Forest Hydrology by John D. Hewlett;
 Additional reading assignments from the recent scientific literature will also be selected to compliment the textbook and will be made available on **Moodle**.

A quick note on the text: I have assigned reading (below) related to the concepts we will cover in this course. *However, I do not expect you to memorize all of the equations within the assigned reading.* I will highlight key concepts and equations from a process perspective within my lectures. Tests, homework assignments, and quizzes will focus on the material that I present within my lectures. The text is a supplement to my lectures.

Additional Course Information and Materials: umonline.umd.edu

On the Moodle site, you will need to enter your Net ID and password to access the course lectures and supplemental readings. Lecture slides will be posted on the course Moodle page. Students will be expected to participate in class during discussions and in class exercises.

Course Schedule:

Date	Topic	Reading	Assignment
8/20-	Course introduction: water in the 21 st century; watershed management.	Hornberger pp. 1-17; 285-294; Moodle Slides	Wagner paper
8/25- 8/27	Concepts in hydrology: Dimensional analysis and unit conversions; hydrologic cycle; watersheds; water balance	Hornberger pp. 297-304 Moodle Slides	Handout
9/1- 9/3	Meteorology and precipitation	Hornberger pp. 20-39 Moodle Slides	Handout
9/8- 9/10	Watershed radiation and energy balances	Hornberger pp. 40-54; Moodle slides	
9/15- 9/17	ET: Evaporation & Transpiration	Hornberger pp. 240-253; Moodle Slides	Handout
9/22- 9/24	Exam 1 (Due 9/25) <i>Soil & Water Properties</i>	Hornberger pp. 305-306 Moodle Slides	
9/29- 10/1	Unsaturated Zone Hydrology	Hornberger pp. 210-222	
10/6- 10/8	Unsaturated Zone Hydrology & Infiltration	Hornberger pp. 222-237	Handout
10/13- 10/15	Groundwater Hydrology	Hornberger pp. 145-169	

10/20- 10/22	Groundwater – Surface Water Interactions	Hornberger pp. 173-183 Moodle Slides	Handout
10/27- 10/29	Exam 2 (Due 10/30)		Review
11/3- 11/5	No Class - Election Day Stream Networks & Hydrographs	Hornberger pp. 118-122; 257-261 Moodle Slides	VOTE
11/10- 11/12	Runoff Generation Runoff Generation	Hornberger pp. 257-282 Moodle slides	
11/17-	Ecohydrology	Hornberger 240-245; Moodle slides	
11/17-	Exam 3 (Due 11/23)		

Assignments: Problem sets will be assigned as handouts on the Moodle site and from the text. Homework assignments are due the following week. Late assignments will be accepted for up to three days from the due date, but 10% will be deducted for every late day. Homework will not be accepted via email. Occasionally, we will go outside on campus to demonstrate common hydrology measurements and place class lecture material in a Missoula ‘watershed context.’ I will notify you ahead of time so you can prepare accordingly (bring warm clothing).

Field Trip: This course typically has a one-day field trip to the Lubrecht Experimental Forest to investigate soil moisture, groundwater-surface water interactions and stream water quality. This is not likely to happen this year given COVID-19 constraints. However, there are multiple ongoing research projects focused on watershed hydrology and ecohydrology at Lubrecht and for the Montana Climate Office. If you are interested in gaining field and research experience please see me.

Review Sessions: From time to time and before exams, I will conduct review sessions to help with questions you have related to the course material. I am not required to host these and you are also not required to attend. I conduct review sessions because I care about your comprehension of the course material. You are responsible for coming prepared with questions and working through questions in groups.

Additional Course Information: A note on course drop deadlines: If you decide to drop this course, you have the first 15 instructional days of the semester to do

so on Cyberbear. **Beginning the sixteenth (16) instructional day of the semester through the forty-fifth (45) instructional day**, you may use paper forms to drop, add and make changes of section, grading option, or credit. However, after 45 days, I will not sign drop forms except under extraordinary circumstances, such as:

1. An accident or illness prevents you from meeting the course requirements
2. You received no evaluation of your performance before the drop deadline
3. A family or personal emergency prevents you from meeting course requirements
4. Your employment schedule changed, preventing you from meeting course requirements

Recommended Preparation: Successful completion of a university-level chemistry course (e.g., CHMY 121N), a physics course (e.g., PHSX 205N) and proficiency in University-level algebra

Students with learning disabilities or disadvantages needing special dispensation or assistance, please see me during the first week of class.

All course activities are governed by the Student Conduct Code, which embodies the ideals of academic honesty, integrity, human rights, and individual responsibility. It is your responsibility to read, understand and adhere to the student conduct code. See <http://www.umt.edu/student-affairs/dean-of-students/default.php> for more information.