NRSM (385) Watershed Hydrology

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Course Time & Location:
T/R 9:40 – 11:00 NS307

Office Hours:
Jencso: Thursday 2:00 – 3:00
Brissette: Wednesday 11:15-12:15

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 inside of 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 fluxes and storage reservoirs; 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 & In Class Participation (5%)
4) Field Trip & Final Report (5%)

The midterm exams will test your knowledge of material covered in class up to that point. The final exam will focus mostly on material covered after the second midterm. All students must practice academic honesty.

Course Text:

Assigned Text: Elements of Physical Hydrology by George Hornberger. 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**.

Additional Course Information and Materials: **UM Online**

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***
1/26-1/28	Introduction: water in the 21st century; watershed management. Hydrology dimensional analysis and unit conversions	Hornberger 1-6; 223-234; 235-242 Moodle: Wagner paper	
2/2-2/4	Concepts in hydrology: hydrologic cycle; watersheds; water balance	Hornberger 7-13 Moodle Slides	Problem set 1
2/9-2/11	Meteorology and precipitation Interception	Hornberger 17-30 Moodle Slides	Problem set 2
2/16-2/18	Watershed Energy Balance	Hornberger 30-39; Moodle Slides	Problem set 3
2/23-2/25	Watershed Energy Balance ET: Evaporation & Transpiration;	Hornberger 30-39 Moodle Slides	Problem set 4
3/1-3/3	***Exam 1*** *Soil Physical Properties*	 Moodle Slides	Review
3/8-3/10	Unsaturated Zone Hydrology	Hornberger 171-196	Problem set 5
3/15-3/17	No Classes Groundwater Hydraulics	Hornberger 123-142	Problem set 6
3/22-3/24	Groundwater Hydrology Groundwater – Surface Water Interactions	Hornberger 145-167 Moodle Slides	
3/29-3/31	Groundwater – Surface Water Interactions & Review **Exam 2**	Moodle Slides	Review
4/5-4/7	SPRING BREAK		RELAX
4/12-4/14	Runoff Generation	Hornberger 199-219 Moodle Slides	Problem set 7
4/19-4/21	Stream Networks & Hydrographs	Hornberger 99-106	
4/26-4/28	Riparian & Hyporheic Zones; Water Quality; Ecohydrology	Moodle Slides	
5/3 5/5	Emerging Topics in Watershed Management **Exam 3**	Moodle Slides	

Date	*Topic*	*Reading*	*Assignment*
4/30 & 5/1	***Lubrecht Weekend Field Trip***		Technical Report

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. 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:

We will take a mandatory one-day field trip to the Lubrecht Experimental Forest to investigate groundwater-surface water interactions and stream water quality. The tentative dates for the trip are April 23 & 24 (this may change depending on the weather). The class will be split into two groups and you have the option of participating on either Saturday or Sunday. Additionally, there are multiple ongoing research projects focused on watershed hydrology and Ecohydrology at the LEF. If you are interested in gaining field and research experience please see the TA or me.

Review Sessions

From time to time and before exams, I may 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. The times scheduled for review sessions are at my discretion and I will not stand up at the board and lecture. You will be responsible for coming prepared with questions and working through these 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 Student Conduct Code for more information.