NRSM (385) Watershed Hydrology

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Course Time & Location:
T/R 8:00 – 9:20
Liberal Arts Room 11

Office Hours:
Jencso: T/R 2:00 – 3:00
Livesay:

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 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 (45%)
3) Quizzes & In Class Participation (5%)
4) Field Trip (5%)
5) 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: Physical Hydrology by Lawrence Dingman (3rd 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: The text selected for this text is highly quantitative. I have assigned reading (below) related to the concepts we will cover in this course. *However, I do not expect you to memorize or understand 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: http://umonline.umt.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***
8/31	Course introduction: water in the 21st century; watershed management.	Dingman 1-6; Moodle Slides & Wagner paper	
9/5-9/7	Concepts in hydrology: Hydrology dimensional analysis and unit conversions; hydrologic cycle; watersheds; water balance	Dingman p 3-28 Moodle Slides	Dingman p 41; Problems 1, 4a, 4b, and 8ai-ii
9/12-9/14	Meteorology and precipitation Interception	Dingman pp. 111-125; 133-165 Moodle Slides	Dingman p 200; Problems 1, 2, 3a, 3b, and 3c
9/19-9/21	Watershed radiation and energy balances	Dingman p 47-59; 226-232 ***Moodle slides & supplemental reading**	Handout
9/26-9/28	ET: Evaporation & Transpiration; Canopy Interception	Dingman 253-292; Moodle Slides	
10/3-10/5	***Exam 1*** *Soil & Water Properties*	Dingman p. 9-13 and 313-320	Dingman p 342;

Date	***Topic***	***Reading***	***Assignment***
		Moodle Slides	Problems 1, 2 and 5
10/10-10/12	Unsaturated Zone Hydrology	Dingman p. 323-360	Dingman p. 343; Problem 7
10/17-10/19	Infiltration	Dingman p. 355-373	
10/24-10/26	Groundwater Hydrology	Dingman p. 389-408 Moodle Slides	Dingman p. 451; Problems 1, 2 and 9
10/31-11/2	Groundwater – Surface Water Interactions & Review	Dingman p. 408-436 Moodle Slides	Review
11/7-11/9	***Exam 2***		
11/14-11/16	Stream Networks & Hydrographs	Dingman p. 455-476; Moodle slides	
11/21 Thanksgiving	Runoff Generation	Dingman p. 478-502; Moodle slides	RELAX!
11/28-11/30	Runoff Generation Riparian and Wetland Hydrology		
12/5-12/7	Ecohydrology		
12/12	**Exam 3**		
Lubrecht Field Trip Saturday 9/30	Groundwater-surface water measurements, weather station measurements, soil moisture measurements. Groundwater drilling and well installation.	Handout on Moodle	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. 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: We will take a **mandatory** one-day field trip to the Lubrecht Experimental Forest to investigate soil moisture, groundwater-surface water interactions and stream water quality. The date for this trip is Saturday September 30th. We will leave campus (in front of forestry building) via bus at 0800. This will be an all-day field trip. 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 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 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.