ESS 110: Climate and Hydrology (4 units)
Fall 2017

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Course Description

This course is an upper division introduction to climate science and hydrology for students in Earth Systems Science, Biological Sciences, Applied Mathematics, and related fields. The goal of the course is to develop an understanding of the conceptual basis of the sciences of climate and hydrology and to introduce quantitative methods that (a) allow interpretation of hydrologic and climate data, (b) describe of linkages between the various components of the hydrologic and climate system, and (c) support decision making in resource management and conservation.

Learning Outcomes: At the end of the course, students should be:

1. Apply foundational knowledge in mathematics and physics in the understanding of the fundamental laws and principles of hydrology and climate [PLO 1]
2. Develop understanding of the global climate and water cycles and their relations with biomes and soils. [PLO 2]
3. Obtain fundamental understating of the basic physical processes and principles that govern the flow of mass and energy in the hydrologic and climate systems [PLO 2]
4. Be familiarized with the major local and global challenges that the climate and hydrologic systems are facing, their relations with human systems (e.g., food and energy), and approaches to mitigate them (e.g., climate change, groundwater depletion [PLO 2]
5. Attain basic understanding of energy and mass exchange processes between the Earth's surface and atmosphere as well as overland subsurface hydrologic processes [PLO 3]
6. Be familiarized with the basics of simulation and modeling processes and gain elementary experience in using computational models [PLO 3]
7. Be able to effectively communicate scientific data quantitatively and qualitatively. [PLO 4]
8. Develop quantitative and qualitative problem solving skills individually and in teams to address real-world hydrologic problems [PLO 5]

Earth Systems Science Program Learning Outcomes

Students in the Earth Systems Science major will achieve the following:

1. Foundational knowledge of physics, chemistry, biology, and mathematics related to Earth systems that supports a working knowledge of basic research methodologies, data analysis, and interpretation for a variety of Earth-related data.

2. Knowledge of major concepts, theoretical principles, experimental findings, and areas of study related to Earth systems science, and comprehension of the interactions between natural Earth systems and human economic, political, and social systems.
3. An ability to employ critical thinking, quantitative and numerical analyses, and hypothesis-driven methods of scientific inquiry in the formulation of research questions, experimental design, application and use of laboratory and field instrumentation, and analysis and interpretation of data related to Earth systems.
4. Effective written and oral communication skills, especially the ability to transmit complex technical information.
5. An ability to work effectively individually and in teams in classroom, laboratory, and field settings.

Pre-requisites

- ENVE 20 OR MATH 15
- MATH 22 OR MATH 12.

Course Materials

- Required Textbook*:* Hydrology and The management of Watersheds, Fourth Edition
- Additional reading materials, date-sets and problem-sets will be provided online

Course Format:

- **Lecture**: 4 hrs/week (two 110 min lectures)
- Class meeting will be divided between regular lectures and problem solving and discussions and student must attend lecture to benefit from these exercises
- Graded in-class and homework problem sets that draw from assigned reading and lectures will be assigned weekly and count towards final grades
- Students will work on mini project that involves solving a real life problem. Students will submit a short report and present to class their findings.

Grading: Letter grade only; late assignments will not be accepted.

The grading scale will be curved based on overall class performance. **You must receive a passing grade of 50% on the final exam in order to pass the course.**

Two Exams	50%
Homework assignments:	30%
In-class assignments:	10%
Project	10%

Course policies:

- Use of web browsing, email, texting, social-media and all forms of electronic noise is not allowed during class time. Do not disrupt class by arriving late or leaving early.
- Complete assigned reading before class starts and participate in class discussions by asking and/or answering questions and commenting.
- Collaborative work will be encouraged and students will be given opportunity to work in groups. Unless explicitly stated, all assignments and exams should reflect individual work.
- Late submission of assignments will not be allowed.

Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty.

a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.

b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an e-mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

d. Examples of academic dishonesty include:

   - Receiving or providing unauthorized assistance on examinations
   - Using unauthorized materials during an examination
   - Plagiarism - using materials from sources without citations
   - Altering an exam and submitting it for re-grading
   - Fabricating data or references
   - Using false excuses to obtain extensions of time or to skip coursework

e. The ultimate success of a code of academic conduct depends largely on the degree to which the students fulfill their responsibilities towards academic integrity. These responsibilities include:

- Be honest at all times.
- Act fairly toward others. For example, do not disrupt or seek an unfair advantage over others by cheating, or by talking or allowing eyes to wander during exams.
- Take group as well as individual responsibility for honorable behavior. Collectively, as well as individually, make every effort to prevent and avoid academic misconduct, and report acts of misconduct, which you witness.
- Do not submit the same work in more than one class. Unless otherwise specified by the instructor, all work submitted to fulfill course requirements must be work done by the student specifically for that course. This means that work submitted for one course cannot be used to satisfy requirements of another course unless the student obtains permission from the instructor.
- Unless permitted by the instructor, do not work with others on graded coursework, including in class and take-home tests, papers, or homework assignments. When an instructor specifically informs students that they may collaborate on work required for a course, the extent of the collaboration must not exceed the limits set by the instructor.
- Know what plagiarism is and take steps to avoid it. When using the words or ideas of another, even if paraphrased in your own words, you must cite your source. Students who are confused about whether a particular act constitutes plagiarism should consult the instructor who gave the assignment.
- Know the rules --- ignorance is no defense. Those who violate campus rules regarding academic misconduct are subject to disciplinary sanctions, including suspension and dismissal.

Accommodations for Students with Disabilities

The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations. The instructor will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please speak with the instructor during the first week of class regarding any potential academic adjustments or accommodations that may arise due to religious beliefs during this term.

Course Outline

Wk	Topic	Book Chapter
1	Math Refresher	Suppl. Reading
2	Climate	Suppl. Reading
3	Intro to hydrology, hydrologic cycle, and water budget	1 and 2
4	Precipitation	3
5	Interception, Evaporation, and Transpiration	4
6	Infiltration, Pathways of water flow, and recharge	5
7	Streamflow Measurements and Analysis	6
8	Groundwater and Groundwater-Surface water Exchange	7
9	Soil Erosion and Sediment Transport	8 and 9
10	Fluvial Processes	10
11	Water Quality	11
12	Managing Wildland Watersheds and Ripraian Systems	12 and 13
13	Water Management Issues & Socioeconomic Considerations	14 and 15
14	Course Project Support	
15	Tools and Emerging Technologies	16
16	Review	

Exams
Exam 1: October 12, 2017
Exam 2: Dec 7, 2017
Exam 3: Course project due Dec 15, 2017