

UNIVERSITY OF CALIFORNIA, MERCED
ENVE 110 – Hydrology and Climate Fall 2021
Admin Building Room 250
Tuesdays and Thursdays 11:30 AM – 1:20 PM
Final Exam Thursday December 16, 2021. 8:00am-11:00am

Instructors:

Name	Email	Office	Office Hours
Dr. Safeeq Khan	msafeeq@ucmerced.edu	Sustainable Research and Engineering 411	Thursday 2pm-3pm, SRE 411, check updates in CatCourses
Dr. Josué Medellín-Azuara	jmedellin@ucmerced.edu	Sustainable Research and Engineering 229	Tue 2pm-3pm, SRE 207, check updates in CatCourses

I. Course Description

Basics of the Global Climate, Hydrologic Cycle, and Critical Zone; Fundamentals of Surface-Atmosphere Water and Energy Exchange in the form of Precipitation, Snow, Evaporation, and Transpiration; Principles of Surface and Subsurface Flow, Statistical and Probabilistic Methods, Unit Hydrograph, Flood Frequency Analysis, Flood Routing.

II. Course Topics

1. Introduction to Hydrology (Dr. Khan)
2. Introduction to Climate and Earth's Energy Budget (Dr. Khan)
3. Precipitation (Dr. Khan)
4. Snow and Snowmelt (Dr. Khan)
5. Evapotranspiration (Dr. Medellín-Azuara)
6. Principles of Subsurface Flow (Dr. Medellín-Azuara)
7. Infiltration and Water Movement in Soils (Dr. Medellín-Azuara)
8. Groundwater in the Hydrologic Cycle (Dr. Medellín-Azuara)
9. Runoff Generation and Streamflow (Dr. Khan)
10. Statistical Methods and Modeling in Hydrology (Dr. Khan, Dr. Medellín-Azuara)

III. Course Goals and Outcomes

This course is an introduction to climate and hydrology and is intended for students to understand how our global, continental, regional, and local climates are invariably linked to the water cycle. The course has about 80% engineering science and 20% engineering design components.

At the end of the course the following goals and outcomes are expected:

1. Apply the conservation of mass and energy equations to control volume analysis to describe quantitatively and qualitatively the connections between the atmosphere and the terrestrial hydrologic cycle.
2. Describe quantitatively and qualitatively the interaction between surface and groundwater processes like infiltration, evapotranspiration, groundwater recharge, and partitioning, and the response of these processes within the watershed to meteorological and climate events.
3. Calculate how essential hydrological processes like snowmelt, groundwater and streamflow respond to perturbations like climate and land-use changes.
4. Apply physical equations to describe quantitatively and qualitatively partitioning processes and movement through porous media, including unsaturated (vadose) and saturated zones.
5. Develop skills and tools to effectively communicate, synthesize, and understand scientific data quantitatively and qualitatively, as well as skills to solve real-world hydrologic problems.

6. Develop skills for evaluating structures for safe and effective passage of floods, understanding of design storm hydrograph and learning methods for estimating probable maximum precipitation (PMP) and probable maximum flood (PMF)
7. Propose and defend water allocation decisions that are grounded in scientifically-based hydrological concepts (pure hydrology) and related knowledge of climate-hydrology interactions emphasizing surface and groundwater processes and watershed responses.

IV. Program Learning Outcomes

1. Ability to apply knowledge of mathematics, science, and engineering
2. Ability to design and conduct experiments, and analyze and interpret data
3. Ability to identify, formulate, and solve engineering problems
4. An understanding of professional and ethical responsibility
5. Ability to communicate effectively
6. The broad education necessary to understand impacts of engineering solutions in a global, economic, environmental, and societal context
7. A knowledge of contemporary issues
8. Ability to use the techniques, skills, and modern engineering tools for engineering practice

V. Course Requirements

- **Required Textbook:** Physical Hydrology, 3rd edition, Dingman, Waveland Press Inc.
- **Computational Requirements:** Access to a computer preferably with MS Office Suite installed (including MS Excel). MS Office free of charge for various operating system can be obtained from the UC Merced software website: <https://it.ucmerced.edu/software-list>.

VI. Course Structure

Lectures: Prepare for each lecture by reading the assigned chapters and come to class prepared to participate in discussion and in-class exercises. This class is in-person instruction ONLY. There will be 10 lecture modules, organized by course topics. Please check individual modules for graded quizzes, discussions, and other assignments.

Homeworks: Homework assignments will be posted on **CatCourses**, check the due date carefully. Please, remember that academic integrity rules apply so you may work with classmates on your homework, but the product that you hand in should be the result of your own work.

Exams. There will be a midterm exam in early October and a final exam in December.

Quizzes, in class work, and participation. Each class module will be conformed by 1) a summary discussion assignment, 2) in class activities and/or participation, and 3) a quiz for the material in the module. Relative weights of each component may change depending on the corresponding amount of effort or other factors but all together, these will constitute 30% of the course grade.

Final Project. Course includes a team final project (Module 5) covering engineering science class topics and engineering design for a flood control case. Check the module for instructions and relevant information you may need for completing this assignment.

VII. Grading

The final grade will be the result of a weighted average of exams, homework's, quizzes and in-class assignments, and a class project as follows:

Mid-term exam	10 %
Final Exam	20 %
Homework	20 %
Quizzes, in class work, participation	30 %
Class Project	20 %

The final grade will be based on the following total point score for the class:

A	$\geq 90\%$
B	80-89%
C	70-79%
D	60-69%
F	$< 60\%$

VIII. Class Expectations and Policies

1. Be on time. Attendance does not equal participation. In order to earn your participation points, you must ask and/or answer questions and engage in discussions. Clickers and other means to record for participation will be employed.
2. This course will be taught in-person, arrive on-time. Filming or recording class sessions requires consent from the instructor.
3. No late assignments except in the case of a medical emergency. In such a case, a doctor's note or medical release or other documentation must be provided. Assignments can be turned in as soon as it is available.
4. Exams may not be missed for any reason except for a medical emergency, in which case, a doctor's note or medical release **must** be provided.
5. Instructors can be reached out via CatCourses messaging or during office hours.
6. The syllabus may change, so please be aware of announcements in CatCourses.

IX. Academic Integrity

1. Every 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.
2. Plagiarism is a type of academic misconduct. Please review the U.C. Merced Library webpage to learn more about what plagiarism is and how to avoid it.
http://libguides.ucmerced.edu/citing_sources/citing-sources_avoiding-plagiarism
3. The U.C. Merced Library link above also contains information on citations.
4. Here is information on common types of plagiarism:
<https://www.bowdoin.edu/studentaffairs/academic-honesty/common-types.shtml>
5. References, also referred to as citations, are ways to document where you obtained content used in your work. This course will use the APA Style for references. You can locate more information on how to create references using the APA format using the Purdue Owl (Online Writing Lab).
https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_style_introduction.html
6. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. **Please make sure to follow the COVID-19 guidelines.** 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 email 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.

7. 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.

X. Diversity, Equity and Inclusion

This class is conducted in accordance to the UC Merced Principles of Community¹, which include recognition and celebration of all identities, values and beliefs. Discrimination on the basis of race, religion, sex, sexual orientation, gender identity, national origin, citizenship documented status, or any other social identity will not be tolerated. All class members including students, teaching assistants, observers and instructors are welcomed to discuss any situation they perceive as harmful or threatening with the instructor in the class, during office hours or by appointment.

XI. 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. Drs. Khan and Medellín-Azuara 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.

¹ <https://www.ucmerced.edu/principles-of-community>

XII. Tentative Weekly Schedule, Please check CatCourses for Updates and Exact Assignment DUE DATE

Week	Day	Date	Topic Outcomes	Reading	Assessments
0	TH	08/26	Syllabus Review and Introduction. Introduction to Hydrology	Ch 1,2	California's Watersheds (Discussion)
1	TU	08/31	Introduction to Hydrology	Ch 1,2	Hydrology and Water Properties (Quiz) Watershed Delineation (HW)
	TH	09/02	Introduction to Climate and Earth's Energy Budget	Ch 3	Climate Change: What's New (Discussion)
2	TU	09/07	Introduction to Climate and Earth's Energy Budget	Ch 3	Earth's Energy (HW)
	TH	09/09	Introduction to Climate and Earth's Energy Budget	Ch 3	Climate and Earth's Energy (Quiz)
3	TU	09/14	Precipitation	Ch 4	Atmospheric Rivers & California's Water (Discussion)
	TH	09/16	Precipitation.	Ch 4	Precipitation (Quiz) and DDF/IDF Analysis (HW)
4	TU	09/21	Snow and Snowmelt	Ch 5	A Tour of the Cryosphere (Discussion)
	TH	09/23	Snow and Snowmelt	Ch 5	Snow and Snowmelt (Quiz) & Snow Hydrology (HW)
5	TU	09/28	Snow and Snowmelt	Ch 5	Snow and Snowmelt (Quiz) & Snow Hydrology (HW)
	TH	09/30	MIDTERM EXAM		
6	TU	10/05	Evapotranspiration	Ch 6 App D	Evapotranspiration (Quiz) & Evapotranspiration (HW)
	TH	10/07	Evapotranspiration	Ch 6 App D	Evapotranspiration (Quiz) & Evapotranspiration (HW)
7	TU	10/12	Evapotranspiration	Ch 6 App D	Evapotranspiration in the Water Balance (Discussion)
	TH	10/14	Water Movement on the Land: Principles of Subsurface Flow	Ch 7	Subsurface Flow (Quiz) Subsurface Flow (HW)
8	TU	10/19	Water Movement on the Land: Principles of Subsurface Flow	Ch 7	Subsurface Flow (Quiz) Subsurface Flow (HW)
	TH	10/21	Water Movement on the Land: Principles of Subsurface Flow	Ch 7	Subsurface Flow (Quiz) Subsurface Flow and Soils (Discussion)
9	TU	10/26	Water and Movement of the Land: Infiltration and Water Movement in Soils	Ch 8	Infiltration and Water Movement (Quiz and HW)
	TH	10/28	Water and Movement of the Land: Infiltration and Water Movement in Soils	Ch 8	Infiltration and Water Movement (Discussion)

Week	Day	Date	Topic Outcomes	Reading	Assessments
10	TU	11/02	Groundwater	Ch 9	Groundwater (Quiz and HW)
	TH	11/04	Groundwater Final Project Progress Report Due 11/5	Ch 9	Groundwater (Quiz and HW) Progress Report Due Final Project
11	TU	11/09	Groundwater	Ch 9	Groundwater in the California Context (Discussion)
	TH	11/11	Runoff Generation and Streamflow	Ch 10	Green Infrastructure for Runoff (Discussion)
12	TU	11/16	Runoff Generation and Streamflow	Ch 10	Green Infrastructure for Runoff (Discussion)
	TH	11/18	Runoff Generation and Streamflow	Ch 10	Green Infrastructure for Runoff (Discussion)
13	TU	11/23	Project Work Day, No class		Runoff Generation and Unit Hydrograph (Quiz)
	TH	11/25	THANKSGIVING BREAK		
14	TU	11/30	Runoff Generation and Streamflow	Ch 9	Runoff generation and Streamflow (Quiz)
	TH	12/02	Statistical Methods & Modeling	App C & F	Statistical Methods & Modeling (Quiz)
15	TU	12/07	Statistical Methods & Modeling Final Project Due	App C & F	Large Scale Modeling (Discussion) Final Project Due
	TH	12/09	Course Review	Ch. 1-10	
16	TH	12/16	FINAL EXAM: 8:00-11:00		