CE 103: Introductory Hydrology
University of California, Berkeley
Civil and Environmental Engineering
Spring 2016

Instructor information:
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Office hours: Monday and Wednesday from 3 to 4:30 pm.

GSI:

Morgan Levy – office hours and preferred contact details to be announced.

Expectations and Pre-requisites:
Introductory Fluid Mechanics is a pre-requisite course.
To complete this course you will also need proficiency in Matlab or an equivalent mathematical programming tool (e.g. R, Python). *While you can use Excel for much of the class, you won't be able to use Excel for everything. It is possible to complete 103 without knowing Matlab at the start of the semester, but you need to commit to learning the basics of Matlab concurrently. Please consult with me if you plan to do this.*

Background:
This is an introductory course on hydrology, the study of water.

Learning Goals:
1. To be able to quantify water in different phases and environmental states.

2. To use conservation of mass to derive governing equations for water flow and storage in different states.

3. To base engineering design criteria on an understanding of the variability of rainfall properties and their translation into variable runoff properties.

4. To conduct team-based research projects that quantify, apply mass balance, and explore the variability of water resources and their consequences for society.

5. To communicate research findings in an engaging and professional way.

The course topics fit into 3 modules. For each topic we will follow a real-world a case study to illustrate its applications.

Content:

1. **Mass conservation and water balance**

Topics: Global water cycle; Forms and transformations of water in the environment; Hydrologic mass balance, control volumes and fluxes; Water flow in soil, Darcy's Law; Water entry to soil, infiltration, matric potentials, Green Ampt Equation; Lateral fluxes and water leaving the soil; Hydraulic groundwater theory; Plant water uptake
Goal: to understand the components of a water balance, use mass conservation principles to construct simple models of hydrological systems, and to appreciate how water balance helps govern the behavior of hydrologic systems.

2. **Hydrology as a random process: Streamflow, rainfall, floods and droughts**

Topics: Random variables, timeseries analysis, variability in rainfall, variability in streamflow, statistics of extreme events, definition of return periods, extreme value distributions, intensity-frequency-duration curves for rainfall
Goal: to understand the random nature of hydrological processes, to analyze random timeseries, to evaluate the effects of randomness on water resources.

3. **Rainfall-runoff modeling**

Physics of channel flow, morphology of channel networks, linear reservoir models, unit hydrograph models, SCS-CN models, design based on flow information
Goal: to compute design storms, design floods, to be familiar with and to use standard methods of flow forecasting, to generate hydrologic designs based on these techniques.

Assessment:

You will be assessed on 4 things:

1) Homework assignments (30%)

The main aim of these assignments is to give you an opportunity to implement or practice techniques covered during class.

2) Two in-class quizzes / exams (20%).

These will cover the Revision, Physical Processes, and runoff generation / data interpretation topics. Their main purpose is to give me a clear idea of how well the class understands these fundamental topics.

3) Three research projects (25%).

This grade includes both conducting research in a team, communicating it via a blog-based platform, offering feedback to your peers about their research, and responding to the feedback you receive in a pro-active fashion.

4) Final Exam (25%)

We will have a 3 hour, closed book final