GEOL 590-002 RIVERS AND FLOODS

INSTRUCTOR: Dr. Antonia Sebastian (she/her/hers), asebastian@unc.edu

SYNCHRONOUS LECTURES:

TR 9:30 to 10:45 am; Zoom Link and Meeting ID: 921 7763 6609; Password: GEOL509

CREDIT HOURS 3.0

PREREQUISITS MATH 231

COURSE DESCRIPTION

River floods are critically important in the global hydrologic cycle. While seasonal floods can be environmentally restorative, they can also have devastating socio-economic and public health consequences. Anthropogenic changes ranging from watershed to global scales have substantially altered the response of many of the world's rivers and are driving increased flood risk, making this a critical topic for the 21st century. Beginning with the hydrologic cycle, this course will cover concepts related to rainfall runoff and hydrologic response, flood frequency analysis, the mechanics of open channel flow, and overland and channel routing. Students will also gain experience working with real-world data and engineering software such as HEC-HMS. At the end of the course, students will be armed with the skills to be able to calculate the frequency and depth of river flooding.

LEARNING OBJECTIVES

By the end of this course, students should be able to:

1. Describe the processes governing the movement of water through the hydrologic cycle, including precipitation, surface runoff, and infiltration
2. Estimate time-varying infiltration and excess runoff during extreme precipitation events
3. Conduct a flood frequency analysis using USGS streamflow data
4. Apply simple flood routing techniques to simulate hydrologic response of watersheds to rainfall
5. Perform uniform flow computations and estimate water surface profiles for gradually varied flow
6. Discuss the challenges of floodplain management, especially in urban and coastal areas

COURSE MATERIALS

Required Textbook

- Bedient, P. B., Huber, W. C., & Vieux, B. E. (2018). *Hydrology and Floodplain Analysis.* 6th Ed., Prentice Hall, Upper Saddle River, NJ.

Useful References (not required)

- Margulis, S. Introduction to Hydrology. Freely available online: https://margulis-group.github.io/textbook/
- Mays. L.E. (2019). *Water Resources Engineering*. 3rd Ed., John Wiley and Sons, Inc.
- Gupta, R.S. (2017). *Hydrology and Hydraulic Systems*. 4th Ed., Waveland Press, Inc., Long Grove, IL.

- Hornberger, G.M., Wiberg, P.L., Raffensperger, J.P., D'Odorico, P. (2014). *Elements of Physical Hydrology*. 2nd Ed., Johns Hopkins University Press, Baltimore, MD.
- Chow, V.T., Maidment, D.R., Mays, L.W. (1988). *Applied Hydrology*, McGraw Hill Inc., New York.

UNC HONOR CODE

In this course, all students will be held to the standards of the UNC honor code in which students are expected to refrain from "lying, cheating, or stealing" in the academic context. If you are unfamiliar with the details of this code or how it is administered, please see me, or consult the Instrument of Student Judicial Governance at honor.unc.edu.

In addition, do not upload any content from this course to the web in any form. If you post my course content, you may be violating my intellectual property rights. If you post your own work from this course, you are allowing sites to profit from your intellectual property. In utilizing web sources to upload or download course content, you risk violating the University's Honor Code.

Note: You are encouraged to work and discuss homework and projects with your peers, so long as the final product is your own.

RESOURCES

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability, or pregnancy complications resulting in difficulties with accessing learning opportunities. All accommodations are coordinated through the Accessibility Resources and Service Office. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.

The University of North Carolina at Chapel Hill Counseling and Psychological Services (CAPS) is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ to learn more.

INCLUSIVITY STATEMENT

All students are welcome in the course regardless of their race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. I value the perspectives of individuals from all backgrounds that reflect diversity on UNC's campus, and I strive to make the classroom, whether in-person or virtual, an inclusive space for all students. Please let me know if there are ways I can improve. I appreciate feedback.

ZOOM PRIVACY STATEMENT

Our class sessions will be audio-visually recorded for students who are unable to attend at the scheduled time. Students who participate with their camera engaged or who utilize a profile image are agreeing to have their audio/video or image recorded. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded.

GRADING

Homework (30%)

Typically, homework will be due by 6pm on the date that is listed at the top of the assignment in order to provide me with enough time to look over your work and provide feedback on the assignment prior to the next class period. There will be approximately five homework assignments during the course. You may work together on homework and/or consult me, but each student must complete their own assignment with all work shown.

Given the uncertainty surrounding COVID-19, please plan to upload a copy of your homework in Sakai in the form of either a legible photograph or scanned copy (if you have access to a scanner). If you choose to work a homework problem using excel and/or Python/R please upload a copy of your excel sheet or annotated code to Sakai. Coding proficiency is not required for this course.

Midterm Exams (40%)

There will be two in-class exams related to the objectives of the course (listed above). Each assessment is intended to serve as a check-point for both you and for me to gauge our collective progress in understanding the major concepts and material covered up until that point in the course.

Final Exam (20%)

There will be a final exam that covers the material from entire course.

Participation (10%)

There will be several low-stakes assignments or in-class activities that you are required to take part in. Any and all low-stakes assignments and in-class activities will be graded based on completion.

Bonus

Bonus points (0.5% per item to a max of 3%) will be given to students who post recent news articles pertaining to pertinent water topics. To obtain the bonus points, you must write a short description of the news article (< half a page) highlighting the premise of the article, the current understanding (both by society and science) of the topic, and how it relates to the content of the course.

ATTENDANCE

Attendance and participation in class discussions and activities is mandatory unless prior arrangements have been made. Excused absences (e.g., university approved absences) must be reported at least one week in advance. Unexcused absences will be handled individually, and you should discuss them with the instructor. You must complete all assignments (oral and written) to pass the course.

LATE POLICY

Late assignments will be penalized at 10% per day.

COURSE TOPICS

Below is a list of the topics I plan to cover this semester. A more detailed course schedule can be found on Sakai. We may discover that we want to spend more time on certain topics if there is special interest and less time on others. I may consider changing the schedule if this would benefit most students in the course and will notify you if there are any changes in the course schedule.

- Hydrologic Principles (Ch. 1)
- Hydrologic Analysis (Ch. 2)
- Frequency Analysis (Ch. 3)
- Flood Routing (Ch. 4)
- Hydrologic Simulation Models (Ch. 5)
- Floodplain Hydraulics (Ch. 7)
- Special Topics