CWR 3540, UO1 (84747)
WATER RESOURCES ENGINEERING - SYLLABUS
Prerequisites: CWR 3201, CWR 3201L and STA 3033 (or equivalent – see the instructor)
Department of Civil and Environmental Engineering
Florida International University
Fall 2024 (In-Person)

Instructor: Professor Fuentes, Ph.D., P.E., B.C.E.E.
Physical Office: EC-3671; Physical Mailbox: EC-3680
Phone No.: 305 348-2837; E-mail: fuentes@fiu.edu (preferred email address)
Home Page: http://myweb.fiu.edu/fuentes/ Course Website: http://web.eng.fiu.edu/fuentes/
Consultation Hours: W: 1:00-4:00 PM & R: 2:30-3:30 PM (all students, first-come, first-served)
For an appointment, please email Professor Fuentes at fuentes@fiu.edu.

Teaching Assistant: Ms. Aida Yahyavi Rahimi, PhD Student
Physical Office: EC-3660; E-mail: arahi015@fiu.edu; Phone No.: (786) 631-1416
Assistance Sessions (in-person, first-come, first served): M: 4:00-6:00 PM; T: 4:00-5:00 PM; and F: 4:00-6:00 PM
For appointments at times other than office hours, please email Ms. Yahyavi at arahi015@fiu.edu

Lecture location and time:
EC-3239 - Tuesday & Thursday: 12:30-1:45 PM

A. Course Description & Objective

Hydrologic and hydraulic engineering theory, principles and methodologies are essential in the professional practice of civil engineering and environmental engineering. They are needed to estimate the quantity of water that is either stored or conveyed in natural and engineered water systems (streams, rivers, storm collectors, channels, reservoirs, ponds, etc.). Their application should support the design and analysis of water resources systems within goals of resilience and sustainability. The main *learning objective* of this course is "to provide basic knowledge to the future civil engineer or environmental engineer to support their solution of problems in water resources engineering". The course will consequently address the nature of water resources issues, hydrologic cycle (i.e., main processes and measurements), surface hydrology, probability analysis, risk and design, and groundwater occurrence, flow and well hydraulics. Examples of relevant questions are: What is a hyetograph? What is the average precipitation on an urban watershed after a rainfall event? What are hydrographs used for? What is the design runoff for a storm collector that drains a parking lot? How does the hydraulic conductivity of soils and rocks relate to groundwater velocity? What soil and rock properties do we need to know to design a well to extract groundwater for water supply? What are the principles and methods that are needed to answer all the previous questions?

This course version completes the required program of study in a 16-week schedule. Professor Fuentes expects each student to commit time, dedication, and discipline to each learning module, as follows:

a) Timely study of assigned material (i.e., textbook sections and selected handouts).

b) Thorough understanding of all textbook example problems in the assigned study material.

c) Timely consultation *with Teaching Assistant or Instructor on the application of theory, methods, and equations to the practice of solving problems, for both required and recommended homework, during their office hours (or by appointment), in preparation for prep-quizzes and exams.*

B. Textbook & Student Study Assignments

Required textbook/material:

1. Gupta, R. S., Hydrology & Hydraulic Systems, Waveland Press, Inc., ISBN: 1-4786-3091-4, Long Grove, IL, 2017. Refer to the student companion site at http://waveland.com/browse.php?t=384&r=a%7C491

2. Selected handouts and additional example problems that are posted on the course website (students must download their own copies).

The assigned study textbook sections and selected handouts, including their solved example problems, are the basic documents of the course. Additional example problems, lecture summaries, required and recommended homework, references, and relevant agency websites are posted on the course website.

The instructor's course website (http://web.eng.fiu.edu/fuentes/) is the official location where students will find all supporting material. Students are welcome to share their input on the course program, in-person at any time, but may also leave confidential, specific, actionable, and respectful feedback in the CANVAS Feedback Box. *CANVAS* is primarily used to post individual grades thus ensuring each student's privacy. The final course grade will be officially posted on *PantherSoft* by the University official deadline (i.e., 12/18/2024).

C. Use & Management of Class Time

Lectures will follow the sequence of topics that are herein listed. Topics cover foundation theory, methodologies, and example problems. Students are expected to have perused assigned material in advance to each lecture, to then enhance their understanding during lectures, as the basis to practice their problem-solving skills, in preparation for all prep-quizzes and exams.

Module	**Assigned Study Material**	**Estimated Lectures**
1.	*Introduction*	
	Program Overview	1
	Water Users, Supplies, and Sustainability	0.5
	Water Demand and Drainage : 1.1-1.10, 1.12, 1.18, 1.19	0.5

	Mass Conservation Principle (handout in course website)	1
2.	*Hydrologic Cycle Elements*	
	Hydrologic Cycle: Handouts, 2.1-2.2	1
	Water Budgets and Balance Equations: 2.3-2.4	1
	Precipitation: 2.5-2.8	2
	Evaporation and Transpiration: 3.1-3.4, 3.7-3.9	2
	Runoff and Infiltration: 4.1, 4.2 (4.2.1), 4.4, 4.5, 4.6	2
	Streamflow Measurements: 8.1-8.9, 8.12 (8.12.1, 8.12.2), 8.13 (8.13.1), 8.18-8.21, 13.1-13.4 (for student review)	2
3.	*Surface Hydrology*	
	Storm Sewer System: 16.1-16.2	1
	Rational Method: 16.10-16.11	1
	NRCS (SCS) TR-55 Method: 16.12, 16.13, 16.14	2
	Hydrographs and Unit Hydrograph Methods: 9.1-9.9 (9.9.1), 9.10-9.12	2
4.	*Probability and Extreme Flows*	
	Probability and Design Flood: 11.1-11.3	1
	Frequency Analysis: 11.6-11.12	2
	PMP and PMS: 11.14-11.16	1
5.	*Groundwater Flow Basics and Applications*	
	Occurrence: 5.1-5.3	1
	Energy Components and Darcy's Law: 5.4-5.9	1
	Groundwater Flow Types and General Equation: 5.10-5.12	1
	Steady and Unsteady Flow Well Hydraulics: 6.1, 6.2-6.4	2

D. Grading Policies (Percentage)

Homework (8-10)	10 (each one graded over 100)
Prep-quizzes (8-10)	15 (each one graded over 100)
Exam No. 1	25 (September 26)
Exam No. 2	25 (November 5)
Final Exam	25 (December 10, EC 3239, 12:00 PM)
Total Maximum	*100*

Required and recommended homework will be posted for students to practice the application of theory, methods, and equations in solving design and analysis problems. All students are strongly encouraged to timely discuss their solutions, before and after grading, with either the TA or the instructor. The required homework is an individual effort; it will be collected on the announced due date, at the start of the lecture. Homework must be presented on engineering paper and organized in accordance with the

official template. Required homework that is not turned into the instructor, when collected, will automatically receive "zero" points. Although effort is made to return graded homework prior to an exam, a pending return of it to the students does not affect the extent of assigned study material for that exam. All students are also encouraged to study and solve additional problems from the textbook or any of the recommended references, either individually or in groups, in preparation for their prep-quizzes and exams.

Prep-quizzes will be given on either Tuesdays or Thursdays at any time. They test your study of assigned material and lecture highlights. They focus on material from most recent and current lectures. Prep-quizzes last about 5 to 10 minutes and are closed book. You are approved to have a scientific calculator and pencils No. 2 with eraser.

Exams Nos. 1, 2 and Final will respectively be held on September 26, November 5, and December 10, 2024. The Final Exam is comprehensive and most possibly includes problems that integrate knowledge from all covered modules. All exams and quizzes are fully closed book and notes and, unless announced exceptions, will comply with the exam protocols of the National Council of Examiners for Engineering and Surveying, NCEES (www.ncees.org), including its approved calculators. During prep-quizzes and exams, the instructor and any proctor(s) do not answer questions that relate to any concepts, methodology or equations that are part of the test questions and problem statements. *The lowest score in Exams 1 and 2 will be replaced by the score of the Final Exam if the latter raises the overall grade.*

No make-up or incomplete grades will be considered, unless properly justified, for instance, documented medical emergencies.

Artificial Intelligence (AI) tools include tools, such as ChatGtP, Elicit, etc.; the tools include text and artwork/graphics/video/audio. Students may use AI tools to help generate ideas and brainstorm. However, it is noted that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Students should be aware that the use of AI may also stifle your own independent thinking and creativity. *Students must not submit any work generated by an AI program as their own. But if a student includes material generated by an AI program, the student should cite it like any other reference material (all students must give due consideration to the quality of any cited reference).*

Final course grade is a function of the total number of points accumulated by the student at the end of the course, as follows:

93.3	≤ A	≤ 100.0	76.7	≤ C+	< 80.0
90.0	≤ A-	< 93.3	70.0	≤ C	< 76.7
86.7	≤ B+	< 90.0	60.0	≤ D	< 70.0
83.3	≤ B	< 86.7		F	< 60.0
80.0	≤ B-	< 83.3			

***ADVICE*: BEGIN YOUR STUDY AND PROBLEM-SOLVING PRACTICE PROMPTLY. DO NOT PROCASTINATE. ANY QUESTIONS ON GRADES THAT YOU MAY HAVE WILL ONLY BE CONSIDERED WITHIN THE FIVE (5) WORKING DAYS AFTER THEIR OFFICIAL ANNOUNCEMENT. ALL TEST GRADES OF HOMEWORK, PREP-QUIZZES AND EXAMS WILL BE POSTED ON CANVAS. THE FINAL COURSE GRADE WILL ONLY BE POSTED ON PANTHERSOFT, AS REQUIRED, BY THE OFFICIAL SUBMITTAL DEADLINE.**

E. Attendance Policies

Class attendance is required, and it is monitored and recorded on the FIU Check In 2.0 Instructor Dashboard (a hard-copy roster is prepared for use in special circumstances only). Students must install and use *FIU Check In 2.0* to check in the lecture on each scheduled day. The procedure uses Bluetooth beacons in the classroom paired with the *FIU Check In 2.0* app where students can check in starting 10 minutes before the scheduled class start time. Please refer to CheckIn2.0_Student.pdf (fiu.edu) for details and, if needed, contact information for technical assistance. Late arrival or early departures are considered absences, and the student must report it, via email by the end of the lecture day, with a justification for consideration by Professor Fuentes. A student with three unacceptable, unjustified absences may be dropped from the course with a DR on November 4, 2024. Students will automatically lose 0.45 points per unjustified absence after November 4, including those prior to that date. *Students with a perfect record of attendance, as recorded in FIU Check In 2.0 (including up to three acceptable, justified absences) will receive 5 points added to the final calculated grade.*

Photographing and (audio- or video-) recording by any student are not allowed during lectures and especially during all testing times (i.e., both prep-quizzes and exams). Any violation will be handled under *Student Conduct and Academic Integrity* policies and procedures.

Students may use one selected e-device *only* to access CWR 3540 study materials (e.g., e-textbook or posted files in the course website or both) during lectures, but that type of use is fully prohibited during quizzes and exams. *Exams and prep-quizzes must be individually completed by each student; any access to the Internet or any type of communication with any organization, individual, or website is considered a violation and may result in grade of "zero" in either the entire quiz or exam or parts of them.*

Students should always carry their *FIU One Card* for official identification purposes and be ready to present it if requested by the Instructor or Teaching Assistant during any scheduled activity, but most especially during prep-quizzes and exams.

F. Days to Remember (refer to the Official FIU 2024-2025 Academic Calendar for details)

2024-2025-academic-calendar---approved-fs-1_25_2022.pdf (fiu.edu)

August 26:	Classes begin.
September 2:	Labor Day (University Closed)
September 26:	Exam No. 1
November 4:	Deadline to drop a course with a DR grade.

November 5:	Exam No. 2
November 11:	Veterans Day (University Closed)
November 28-30:	Thanksgiving Day and Break
December 7:	Classes end
December 10:	Final Exam (EC-3239, 12:00 PM)
December 18:	Deadline (by 11:59 PM) for faculty to submit grades.

The instructor will comply and enforce all applicable FIU's Policies and Regulations. It is the students' responsibility to know all applicable policies and requirements. All students should refer, for details, to the FIU posted *Student Conduct and Honor Code* at

docs=322. (fiu.edu)

All students are deemed by the university to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the FIU Student Handbook. Misconduct includes, among other, *cheating, plagiarism, misrepresentation misuse of computer services, bribery, conspiracy and collusion, falsification of records and academic dishonesty*. For details visit

Student Conduct and Academic Integrity | Division of Academic & Student Affairs | Florida International University (fiu.edu)

Students should be aware of both Panthers Care and CAPS services for students, which support their well-being.

G. Some Recommended References

In addition to a diverse number of references that are located at the Steve and Dorothea Green Library, Professor Fuentes recommends the following selections for students to either complement or expand their study:

Bedient, P. B., W. C. Huber and B. E. Vieux, "*Hydrology and Floodplain Analysis*," Prentice-Hall, Upper Saddle River, NJ, 2008.

Julien, P. Y., "Essentials of Hydraulics", Cambridge University Press, Cambridge CB@ Press, United Kingdom, 2022.

Mays, L. W., *"Ground and Surface Water Hydrology,"* John Wiley & Sons, Inc.. Hoboken, NJ, 2012.

Mays, L. W., "*Water Resources Engineering"*, John Wiley & Sons, Inc., Hoboken, NJ, 2011.

Roberson, J. A., J. J. Cassidy and M. H. Chaudhry, *"Hydraulic Engineering,"* John Wiley & Sons, Inc. New York, NY, 1998.

Viessman, Jr., W. and G. L. Lewis, Introduction to Hydrology, 4th Edition, Prentice-Hall, Upper Saddle River, NJ, 2003.

Wurbs, R. A. and W. P. James, Water Resources Engineering, Prentice-Hall, ISBN: 0-13-081293-5, Upper Saddle River, NJ, 2002.

Important relevant websites with rich-supporting information:

www.nws.noaa.gov, www.nrcs.usda.gov, www.usgs.gov

H. Relationship to ABET Objectives & Outcomes

This course is required from all students. Its contents relate and make a partial contribution to the following objectives:

Outcome (1): An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. *Example: Use of equations that are derived from the mass conservation principle to express the relationship between precipitation and direct runoff and its use to estimate a peak flow to design the capacity of a storm collector.*

Outcome (2): An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. *Example 1: Estimation of the needs of water users to ensure water supply for the population and economic activities of communities, such as agriculture and industry. Example 2: Use of rainfall data collected at a rain gage over a 10-year period to assess the probability distributions that represent rainfall depth.*