CWR 3540, UO1 (84885, 85255)
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 2023 (In-Person)

Instructor: Professor Fuentes, Ph.D., P.E., B.C.E.E.
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Home Page: http://myweb.fiu.edu/fuentes/ Course Website: http://web.eng.fiu.edu/fuentes/
Office Hours: W & R: 2:00 - 4:00 PM (in-person, 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;
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Assistance Sessions (in-person, first-come, first served): M: 11:30AM-12:30PM, T: 4:00-5:00PM; TH: 4:00-6:00PM; and F: 4:00-6:00PM
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, 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 and course website handouts).

b) Thorough mastering of all textbook example problems beyond lecture presentation.

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

B. Textbook & Reading 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 Examples that are posted in the Course Website (students must download their own copies).

The assigned study textbook sections, including their solved examples, and called for posted handouts (i.e., course website) are the prime information of the course. Students are also provided with additional example problems on the course website, in support of their preparation for quizzes and exams. Audio Video Aids, Lecture Summaries, Recommended Homework and Reference Websites are posted on the course website for any student who wishes to further research any topic of study.

The instructor's course website is the official location where students will find all supporting materials, including syllabus, additional example problems, required and recommended homework, handouts, websites, and references. *CANVAS* is primarily used to post individual grades thus ensuring each student's privacy. The final course grade will be officially posted on *Panther Soft* by the University official deadline (i.e., 12/13/2023).

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 *all* assigned material in advance to each lecture, to thus reaffirm their understanding during lectures, problem solving practice and exam preparation.

Module	**Assigned Study Material**	**Estimated Lectures**
1.	*Introduction*	
	Program Overview	1
	Water Users, Supplies, and Sustainability (UNDP)	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 (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 28)
Exam No. 2	25 (November 2)
Final Exam	25 (December 5, EC 3239, 12:00 PM)
Total Maximum	*100*

Required and recommended homework will be posted for students to practice the application of theory and methodologies in design and analysis problems. Students are strongly encouraged to timely discuss their solutions, before and after grading. The required homework is an individual effort (only); 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 in to 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 recommended references, individually and in a group, in preparation for their exams.

Unless it is directed by Professor Fuentes, with specific guidelines and conditions, the use of Artificial Intelligence (AI) aids is not acceptable in the completion of homework (including quizzes and exams, which are proctored).

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 the most recent and current lectures. Quizzes last about 5 to 10 minutes and are closed book. You are approved to have a scientific calculator and 2 pencils No. 2 with eraser.

Exams No. 1, 2 and Final will respectively be held on September 28, November 2, and December 5, 2023. 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 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 helps to raise the overall grade.*

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

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, QUIZZES AND EXAMS WILL BE POSTED ON CANVAS. THE FINAL COURSE GRADE WILL ONLY BE POSTED ON PANTHERSOFT 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 and a hard-copy roster (the latter in special circumstances). Beginning this Fall 2023 semester, students will install and use *FIU Check In 2.0* to check in the lecture on each scheduled day. The updated check-in solution will use Bluetooth beacons instead of QR codes in the classroom paired with a new *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, if needed. Late arrival or early departures are considered absences and the student must report it, with a justification as it may be applicable, via email to the instructor by the end of the day. A student with three unacceptable, unjustified absences may be dropped from the course with a DR on October 30. Students will automatically lose 0.45 points per unjustified absence after October 30, including those prior to October 30. *Students with a perfect record of attendance, as recorded in FIU Check In 2.0 and roster, when needed (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 at any time 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 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 quizzes and exams.

F. Days to Remember (refer to the Official FIU 2023-2024 Academic Calendar for details)

UG_Academic_Calendar.pdf (fiu.edu)

August 21:	Classes begin.
September 4:	Labor Day (University Closed)
September 28:	Exam No. 1
October 30:	Deadline to drop a course with a DR grade. Last day to withdraw from the University with a WI grade.
November 2:	Exam No. 2
November 10:	Veterans Day (University Closed)
November 23-25:	Thanksgiving Day and Break
December 5:	Final Exam (December 5, 2023, EC-3239, 12:00 PM)

December 2: Classes end
December 13: Deadline (by 11:59PM) 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 Student Handbook* (which includes the Student Code of Conduct) at

https://studentaffairs.fiu.edu/about/student-handbook/index.php

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.

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 websites:

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.*