ce-4353-2022-3-Syllabus

February 1, 2023

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1 CE 4353 Design of Hydraulic Systems/CE 5360 Open Channel Hydraulics

1.1 Course Description:

Design of open channel and closed-conduit conveyance systems for water; includes introduction to HEC-RAS.

1.2 Catalog Description

CE 4353: title (3:3:0).

1.3 Prerequisites:

CE 3305 Engineering Fluid Mechanics and CE 3354 Engineering Hydrology. Familarity with computational thinking as examined in ENGR 1330 and EGR 1207.

1.4 Course Sections (in this syllabus)

Lesson time, days, and location:

1. CE 4353 Section 001; CRN 12146; 1500-1620 M,W ; CE 205
2. CE 5360 Section 001; CRN 44840; 1500-1620 M,W ; CE 205
3. CE 5360 Section D01; CRN 44840; asyncronyous distance

1.5 Course Instructor:

Instructor: Theodore G. Cleveland, Ph.D., P.E., M. ASCE, F. EWRI

Email: theodore.cleveland@ttu.edu (Put CE 4353 Hydraulics)

Office location: Telepresence (Zoom)

Office hours: TBD

1.6 Teaching assistants:

Assistant: Not Authorized

Email : NA

Office location: NA

Office hours: NA

1.7 Textbook:

Sturm, T. Open Channel Hydraulics, 3 rd Ed. **Link is to Amazon**. The book should be available in TTU Bookstore. Chegg also rents copies.

1.8 Instructor Notes

Cleveland, T.G. (2022) Hydraulic System Design *JupyterBook notes to accompany CE 4353/CE 5360 at TTU*

1.9 Course Schedule

Date	Lesson	Readings	Homework
29 AUG 2022	0. Introduction - Syllabus - Blackboard - Web server	Open Channel Hydraulics Chapter 1	- none
31 AUG 2022	1. Computational Tools - Jupyter Notebooks - Excel Spreadsheets - Specialized software (HEC-RAS;SWMM; etc.)	- none	
07 SEP 2022	2. Basic Principles - Define open channel - Flow regimes - Basic Equations	Ch 1	EC1 (optional)
12 SEP 2022	3. Specific Energy - I - Definition - SE Diagram - Choke	Ch 2 - 2.1-2.3	ES1 Due
14 SEP 2022	4. Specific Energy - II - Froude Number - Critical Depth - Contractions/Expansions - Overbank	Ch 2 - 2.3-2.7	

Date	Lesson	Readings	Homework
19 SEP 2022	5. Weirs - Critical Depth - Measuring Discharge	Ch 2 - 2.8	ES2 Due
21 SEP 2022	6. Momentum - I - Definition - Momentum Function (Rectangular Cross Section)	Ch 3 - 3.1-3.3	
26 SEP 2022	7. Momentum - II - Momentum Function (Arbitrary Cross Section) - Hydraulic Jumps	Ch 3 - 3.4-3.5	ES3 Due
28 SEP 2022	8. Momentum - III - Surges - Bridge Piers - Spur Dikes	Ch 3 - 3.5-3.6	
03 OCT 2022	9. Uniform Flow - I - Definitions - Manning's n - Normal depth	Ch 4 - 4.1-4.5 -subtopic 2	ES4 Due
05 OCT 2022	10. Uniform Flow - II - Gutters and Inlets - Gravity Sewers	Ch 4 - 4.6-4.9 -subtopic 2	
10 OCT 2022	11. Uniform Flow - III - Compound Channels	Ch 4 - 4.10-4.12 -subtopic 2	ES5 Due
12 OCT 2022	12. Uniform Flow - IV - Rip-Rap Lined Channels - Vegetative Lined Channels	Ch 4 - 4.13-4.15 -subtopic 2	
16 OCT 2022	Exam 1 Due	Submit on Blackboard	
17 OCT 2022	13. Uniform Flow - V - Natural Channels - Flood Control Channels	Ch 4 - 4.16-4.18 -subtopic 2	
19 OCT 2022	14. Gradually Varied Flow - I - Definitions - Explicit Fixed Depth Changes	Ch 5 - 5.1-5.3 -subtopic 2	
24 OCT 2022	15. Gradually Varied Flow - II - Water Surface Profiles - Explicit Fixed Depth Changes	Ch 5 - 5.4-5.7 -subtopic 2	ES6 Due

Date	Lesson	Readings	Homework
26 OCT 2022	16. Gradually Varied Flow - III - Water Surface Profiles - Implicit Fixed Spatial Changes	Ch 5 - 5.8-5.10 -subtopic 2	
31 OCT 2022	17. HEC-RAS Introduction - subtopic1 -subtopic 2	topic name - subtopic1 -subtopic 2	ES7 Due
02 NOV 2022	18. HEC-RAS Steady - subtopic1 -subtopic 2	topic name - subtopic1 -subtopic 2	
07 NOV 2022	19. Culvert Design - subtopic1 -subtopic 2	Mays Ch. 16 - subtopic1 -subtopic 2	ES8 Due
09 NOV 2022	20. Other Hydraulic Structures - subtopic1 -subtopic 2	Mays Ch. 16 - subtopic1 -subtopic 2	
14 NOV 2022	21. Other Hydraulic Structures - subtopic1 -subtopic 2	Mays Ch. 16 - subtopic1 -subtopic 2	ES9 Due
16 NOV 2022	22. HEC-RAS Application - subtopic1 -subtopic 2	topic name - subtopic1 -subtopic 2	
20 NOV 2022	Exam 2 Due	Submit on Blackboard	
21 NOV 2022	23. HEC-RAS Application - subtopic1 -subtopic 2	topic name - subtopic1 -subtopic 2	
28 NOV 2022	24. Sediment Transport - subtopic1 -subtopic 2	Mays Ch. 18 - subtopic1 -subtopic 2	Project Report Due
30 NOV 2022	25. Hydraulic Profiles in Wastewater Plants - I - subtopic1 -subtopic 2	topic name - subtopic1 -subtopic 2	
05 DEC 2022	26. Hydraulic Profiles in Wastewater Plants - II - subtopic1 -subtopic 2	topic name - subtopic1 -subtopic 2	
13 DEC 2022	Exam 3 Due	Submit on Blackboard	

1.10 Learning Outcomes:

On completion of the course, students will have 1. Performed hydraulic analysis of various steady-flow situations of practical engineering interest. 2. Sized (diameter and barrel count) a culvert to convey a design flow determined by hydrologic methods. 2. Computed hydraulic profiles of flow through a wastewater treatment plant. 3. Performed a hydraulic analysis of a drainage situation using HEC-RAS software. 4. Summarized HEC-RAS results in an engineering report. 5. Summarized and synthesized information from hydraulic engineering literature into a review document (CE-5360)

1.11 ABET Student Outcomes

- General Engineering:

ABET Outcome	Assessment
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	application of fluid mechanics principles and computer modeling of open channel flow
(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	design of open channels of various shapes and bed materials, selection of culvert design for required flow
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	application of HEC-RAS for open channel flow modeling and assorted jupyter notebook calculation

- Civil Engineering Program Criteria:

ABET Outcome	Assessment
(v) proficiency in water resources engineering	applications of fluid mechanics and open channel flow principles for water transmission
(vii) design a system, component, or process in more than one civil engineering context	design of open channels of various shapes and bed materials, selection of culvert design for required flow

- Environmental Engineering Program Criteria:

ABET Outcome	Assessment
(iv) an ability to perform engineering design by means of design experiences integrated throughout the professional component of the curriculum	design of open channels of various shapes and bed materials, selection of culvert design for required flow

1.11.1 Specialized Software

1. HEC-RAS the U.S. Army Corps of Engineers' software package for modeling constant flows and flood-wave movement through a series of river cross sections, including the presence of a culvert structure. The software and documentation are available free of charge and will be identified at the appropriate time.

1.12 Course Assessment and Grading Criteria:

There will be three exams and one comprehensive final project for the course.
In addition, lab participation, quizzes, and assignments also contribute to the final grade.
Late assignments will not be scored.

Grades will be based on the following components; weighting is approximate:

Assessment Instrument	Weight(%)
Attendance	10
Homework	30
Exam 1	10
Exam 2	20
Exam 3	20
Project	10
Overall total	1000

Letter grades will be assigned using the following proportions:

Normalized Score Range	Letter Grade
90	A
80-89	B
70-79	C
55-69	D
< 55	F

1.13 Classroom Policy:

The following activities are not allowed in the classroom: Texting or talking on the cellphone or other electronic devices, and reading non-course related materials. ### Telepresence (On-line) Courses Obviously electronic devices are vital; disrupting the webinar is prohibited, please mute your microphone unless you have a question - consider typing your question into the chat window as well.

1.14 ADA Statement:

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make necessary arrangements. Students must present appropriate verification from Student Disability Services during the instructor's office hours. Please note that instructors are not allowed to provide classroom ac-

commodation to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services office in 335 West Hall or call 806.742.2405.

1.15 Academic Integrity Statement:

Academic integrity is taking responsibility for one's own class and/or course work, being individually accountable, and demonstrating intellectual honesty and ethical behavior. Academic integrity is a personal choice to abide by the standards of intellectual honesty and responsibility. Because education is a shared effort to achieve learning through the exchange of ideas, students, faculty, and staff have the collective responsibility to build mutual trust and respect. Ethical behavior and independent thought are essential for the highest level of academic achievement, which then must be measured. Academic achievement includes scholarship, teaching, and learning, all of which are shared endeavors. Grades are a device used to quantify the successful accumulation of knowledge through learning. Adhering to the standards of academic integrity ensures grades are earned honestly. Academic integrity is the foundation upon which students, faculty, and staff build their educational and professional careers. [Texas Tech University ("University") Quality Enhancement Plan, Academic Integrity Task Force, 2010].

1.16 Religious Holy Day Statement:

"Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20. A student who intends to observe a religious holy day should make that intention known to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. A student who is excused may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.

1.17 Ethical Conduct Policy:

Cheating is prohibited, and the representation of the work of another person as your own will be grounds for receiving a failing grade in the course.