CEN 321 Hydraulic System Reliability and Safety

Winter 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email:TBA

COURSE OBJECTIVES

This course is designed to provide a comprehensive understanding of the principles, applications, and design of hydraulic systems. Hydraulics plays a crucial role in various engineering fields, including civil, mechanical, aerospace, and industrial engineering. Students will delve into the review of fundamental principles before progressing to more intricate topics such as flow in complex pipe systems, centrifugal pumps, open channel flows, and hydraulic modeling.

Upon Completion of this Course, students will be able to:

1. Understand the principles governing fluid flow in complex pipe networks, including series and parallel pipe arrangements, as well as the application of energy and momentum equations；

2. Gain a comprehensive understanding of the theory behind centrifugal pumps, their operational characteristics, selection criteria, and practical considerations in pumping systems；

3. Understand the dynamics of unsteady flow conditions, including water hammer effects, transient flow analysis, and the application of numerical methods to model unsteady hydraulic phenomena；

4. Learn about physical and numerical hydraulic modeling techniques, including the design and interpretation of models to simulate and analyze real-world hydraulic systems.

PREREQUISITES

CEN 215 Introduction to Fluid Mechanics

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
2 Assignments	20 Points
2 Group Projects	10 Points
Midterm	20 Points
2 Labs	30 Points
Final Exam	20 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

1. Ram S. Gupta, ***Hydrology and Hydraulic Systems***, 4th Edition, Waveland Press, 2017.
2. Terry W. Sturm, ***Open Channel Hydraulics***, 3rd Edirion, McGraw-Hill, 2021.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Development Of Water Resources Topic 2: Elements of the Hydrologic Cycle: Precipitation Topic 3: Elements of the Hydrologic Cycle: Evaporation and Transpiration Topic 4: Characteristics of Open Channel Flow

	Assessments: Assignment#1
Module 2	**Topics:** Topic 5: Solution of Open Channel Flow Problems Topic 6: Single Pipelines With Pumps Topic 7: Multiple Pump System Topic 8: Measurement of Surface Water Flow **Assessments:** Assignment#2 Lab#1: Fluid Properties and Flow Measurements
Module 3	**Topics:** Topic 9: Measurement By Current Meter Topic 10: Steady-State Flow And Unsteady-State Flow Topic 11: Unsteady-State Flow Equations Topic 12: Hydraulic models **Assessments:** Midterm Group Project#1
Module 4	**Topics:** Topic 13: Rigid Channel Carrying Sediment-Free Water Topic 14: Uniform Flow Topic 15: Gradually Varied Flow Topic 16: Hydrologic Routing **Assessments:** Group Project#2 Lab#2: Troubleshooting Hydraulic Systems
Module 5	**Topics:** Topic 17: Estimation of Surface Water Flow: Streamflow Relationships Topic 18: Computation of Extreme Flows Topic 19: Kinematic Wave Theory Topic 20: Streamflow Routing By The Kinematic Theory **Assessments:** Final Exam

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.
2) Assignments submitted in the wrong format will be counted as not submitted.
3) Failure to submit or fulfill any required course component results in failure of the class.
4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed.

The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.