TED UNIVERSITY

CE 331
Hydromechanics

SYLLABUS/SUMMER 2022

Course Information

Required or Elective	☑Required ☐Elective	**Date Prepared**	June 2022
Semester	Summer 2022	**Class Hours, Lab. Hours and Classrooms**	Class Hours: Mon. 09:00-12:00 (D228) Tue. 09:00-12:00 (D228) Lab Hours: Wed. 09:00-13:00 (DB02)
Course Credit Hours/ ECTS credits	(3+0+2) 4 / 6	**Pre-requisite/ Co-requisite**	CE 232
Level of Course	Junior	**Language of Instruction**	☑ English ☐ Turkish
Instructors and their office hours	Dr. Aslı Numanoğlu Genç (asli.genc@tedu.edu.tr) (Office: D301) The office hours can be set by appointment.		
Teaching Assistant(s)	Res.Asst. Neslihan Pınar Gödek (npinar.godek@tedu.edu.tr)		
Student Assistant(s)	NA		
Textbook			
Recommended Readings	1. Lecture notes on *lms.tedu.edu.tr* 2. Munson, B.R., Okisihi, T.H., Huebsch, W.W. and Rothmayer, A.P. (2013). *Fundamentals of Fluid Mechanics.* Global Edition, New Jersey, John Wiley & Sons. 3. Chow, V.T. (2009). *Open-Channel Hydraulics.* New Edition, The Blackburn Press. 4. Günyaktı, A. and Günyaktı, A. (2020). *Hydromechanics.*1st Edition, Nobel Yayınevi.		
Course Web Pages	Please register to Moodle page http://lms.tedu.edu.tr and regularly follow this link to have access to course materials.		

Course Description

Laminar and turbulent flows. Friction factor in pipe flow. Computation of flow in single pipes. Hydraulic machinery: turbines and pumps. Pipeline systems and networks. General characteristics and classification of open channel flow: pressure and velocity distribution. Continuity equation. Energy concept. Momentum principle. Uniform flow. Rapidly varied flow, gradually-varied flow. Design of non-erodible and erodible channels.

Course Objective

The aim of the course is to teach the basic concepts of flows in pipes and open channels; to apply continuity, momentum and energy principles for the solution of various pipeline and open channel problems.

Course Learning Outcomes

On successful completion of this course students will be able to use the basic fluid mechanics principles to solve pipe and channel flow problems, apply the knowledge of mathematics and fluid mechanics to design and conduct experiments to analyze and interpret data and analyze and design pipeline systems and open channel systems.

Specifically, students will be able to,

1. Identify and understand various characteristics of the flow in pipes **[B1]**.
2. Discuss the main properties of laminar and turbulent pipe flow and appreciate their differences **[B2]**.
3. Analyze losses in straight portions of pipes as well as those in various pipe system components **[B4]**.
4. Apply appropriate equations and principles to analyze a variety of pipe flow situations **[B3]**.
5. Predict flow rate in a pipe by use of common flow meters **[B6]**.
6. Determine the hydraulic characteristics of pipeline systems **[B4]**.
7. Discuss the general characteristics of open-channel flow **[B2]**.
8. Use a specific energy diagram **[B3]**.
9. Apply appropriate equations to analyze open-channel flow with uniform depth **[B3]**.
10. Calculate key properties of a hydraulic jump **[B4]**.
11. Determine the dimensions of an open-channel **[B4]**.

Course Assignments

A. ***Attendance (4%):*** You are required to attend at least 90% of the lectures to get the 4%. No partial grade will be given from the attendance.

B. ***Quizzes (56%):*** There will be 7 quizzes each having 8% weight of overall grade.

C. ***Lab reports (15%):*** Students are expected to complete at least **six mandatory laboratory** sessions throughout the semester. **If you fail to complete mandatory laboratory sessions, you will fail the course.**

D. ***Final Exam (25%):*** There will be a cumulative final exam at the end of the semester.

Course Assessments & Learning Outcomes Matrix

Assessment Methods	Course Learning Outcomes
Quizzes	All
Lab reports	All
Final Exam	All

Relationship to Program Outcomes

This course contributes to fulfillment of the following program outcomes:

- Apply knowledge of mathematics, science, and engineering to design and implement original, innovative and sustainable civil engineering systems or processes to meet desired needs within a greater societal context **[PO2]**.
- Design and conduct experiments; analyze and interpret data **[PO5]**.
- Identify, formulate, and solve engineering problems **[PO6]**.
- Demonstrate effective oral and written professional skills in English **[PO7]**

Teaching Methods & Learning Activities

☑ Telling/Explaining
☑ Discussions/Debates
☑ Questioning
☑ Reading
☐ Peer Teaching
☐ Scaffolding/Coaching
☑ Demonstrating
☑ Problem Solving
☑ Inquiry
☐ Collaborating
☐ Think-Pair-Share
☐ Predict-Observe-Explain
☐ Microteaching
☐ Case Study/Scenario Analysis
☐ Simulations & Games
☐ Video Presentations
☐ Oral Presentations/Reports
☐ Concept Mapping
☐ Brainstorming
☐ Drama/Role Playing
☐ Seminars
☐ Field Trips
☐ Guest Speakers
☐ Hands-on Activities
☐ Service Learning
☐ Web Searching
☑ Experiments
☐ Other(s):

Student Workload

☑ Lectures ..... **42** ...hrs
☑ Course Readings ..... **35** ...hrs
☐ Workshop ....hrs
☐ Online Discussion..... .....hrs
☐ Debate ....hrs
☐ Work Placement ....hrs
☐ Field Trips/Visits ....hrs
☐ Observation ....hrs
☑ Lab Applications ..... **40** ...hrs
☐ Hands-on Work..... .....hrs
☑Exams/Quizzes ..... **35** ...hrs
☐ Resource Review..... .....hrs
☐ Research Review .... hrs
☐ Report on a Topic .... hrs
☐ Case Study Analysis .... hrs
☐ Oral Presentation..... ..... hrs
☐ Poster Presentation..... ..... hrs
☐ Demonstration .... hrs
☐ Web Designs..... ..... hrs
☐ Mock Designs .... hrs
☐ Team Meetings..... ..... hrs
☐ Other:..... …. hrs
TOTAL ..... **152** .. hrs

Assessment Methods

☑ Test/Exam
☑ Quiz
☐ Oral Questioning
☐ Performance Project
☐ Written ☐Oral
☐ Observation
☐ Self-evaluation
☐ Peer Evaluation
☐ Portfolio
☐ Presentation (Oral, Poster)
☑ Other(s): Laboratory reports

Course Outline

Week	Topic
1	**1. INTRODUCTION** 1.1. Review of integral equations
-	**2. FLOW IN CLOSED CONDUITS**
2	**2.1. General Characteristics of Flow in Closed Conduit** 2.1.1. Definition of laminar and turbulent flows 2.1.2. Entrance Region and Fully Developed Flow 2.1.3. Head Losses in Pipes
3	**2.2. Fully Developed Flow in Closed Conduits** 2.2.1. Derivation of Darcy-Weisbach Equation 2.2.2. Laminar Flow in Pipes 2.2.3. Turbulent Flow in pipes 2.2.4. Moody Chart
4	**2.3. Computation of Flow in Single Pipes** 2.3.1. Calculation of head losses (Type I) 2.3.2. Calculation of Velocity (Discharge) (Type II) 2.3.3. Calculation of pipe diameter (Type III) 2.3.4. Friction Loss for Non-circular Conduits **2.4. Non-uniform Flow in Closed Conduits** 2.4.1. Local (Minor) Losses 2.4.2. Flowmeters
5	**2.5. Pipeline Systems** 2.5.1. Pipes in series 2.5.2. Pipes in parallel 2.5.3. Branching pipes, junctions
6	2.5.4. Network solutions: Hardy-Cross method
7	2.5.5. Hydraulics and operation of pumped discharge lines
8	2.5.6. Hydraulics and operation of gravity pipelines
-	**3. OPEN CHANNEL FLOW**
9	**3.1. General Characteristics of Open Channel Flow** 3.1.1. Classification of open channel flows 3.1.2. Pressure distribution in open channel flows 3.1.3. Velocity distribution in open channel flows
10	**3.2. Uniform Flow** 3.2.1. Resistance in open channel flow 3.2.2. Uniform flow equations (Chezy and Manning formulas) 3.2.3. Composite and compound sections
11	**3.3. Specific-Energy Concept** 3.3.1. Specific energy and alternate depth 3.3.2. Critical flow 3.3.3. Channel transitions and choking problems
12	**3.4. Rapidly Varied Flow, Specific Force Concept** 3.4.1. Specific force and conjugate depth 3.4.2. Hydraulic jump
13	**3.5. Gradually Varied Flow** 3.5.1. General equation of gradually varied flow 3.5.2. Types of slopes 3.5.3. Longitudinal flow profiles
14	**3.6. Design of Open Channels for Uniform Flow** 3.6.1. Hydraulic efficiency of cross-sections 3.6.2. Design of non-erodible channels 3.6.3. Design of erodible channels

Course Policies and Some Remarks

General

1. Date for the final exam will be announced at the end of the semester by the University. The final exam will cover all topics.
2. Cell phones should be turned off and kept out of sight during the classes. You are not also allowed to use your computers/ tablets etc. at the classroom.
3. If you are late for more than 10 minutes, please do not enter the class.
4. You are not allowed to use cell phones during the exams.

Attendance

In order to be admitted to the final examination, a student **must have attended at least 70% of the lectures and all six laboratory sessions**. Students not fulfilling these conditions will not be permitted to enter the final examination. Students not given the permission to take the final examination will automatically receive the grade **FX** at the end of the semester.

Make Up Exams

Make-ups for midterm exams will NOT be offered generally. If you have a legitimate reason for missing an exam, then you must arrange to make up the exam BEFORE the scheduled time of the exam. The only exceptions are illness or emergency. In case of an illness or emergency you need to supply a documentation that supports your claim. Also please read the document given in the link: http://www.tedu.edu.tr/tr/main/yonetmelikler-ve-yonergeler

Calculator Policy

You may use a calculator during exams.

Plagiarism

All of the following are considered plagiarism:

- "Turning in someone else's work as your own
- Copying words or ideas from someone else without giving credit
- Failing to put a quotation in quotation marks
- Giving incorrect information about the source of a quotation
- Changing words but copying the sentence structure of a source without giving credit
- Copying so many words or ideas from a source that it makes up the majority of your work, whether you give credit or not" (www.plagiarism.org)

Plagiarism is a very serious offense and will be penalized accordingly by the university disciplinary committee. The best way to avoid accidentally plagiarizing is to work on your own before you ask for the help of other resources. Collaboration on non-collected homework and in studying is strongly encouraged; however, the work you hand in must be solely your own. For more information on TEDU policy on intellectual integrity see the "Student Handbook" in the following link: https://student.tedu.edu.tr/tr/student

Cheating

Cheating has a very broad description which can be summarized as "acting dishonestly". Some of the things that can be considered as cheating are the following: copying answers on exams, homework and lab works, using prohibited material on exams, lying to gain any type of advantage in class, providing false, modified or forged data in a report, plagiarizing, modifying graded material to be re-graded, causing harm to colleagues by distributing false information about an exam, homework or lab. Cheating is a very serious offense and will be penalized accordingly by the university disciplinary committee. For more information on TEDU policy on intellectual integrity, see the "Student Handbook" in the following link: https://student.tedu.edu.tr/tr/student.

Disability Support

If you have a disabling condition which may interfere with your ability to successfully complete this module, please see Handbook for Registered Students.