TED UNIVERSITY

CE 232
Fluid Mechanics

SPRING 2022

Course Information

Required or Elective	☑Required ☐Elective	**Date Prepared**	February 2022
Semester	Spring 2022	**Class Hours, Lab. Hours and Classrooms**	Section 1: Mon.: 11:00-12:50 (F304) Wed.: 12:00-12:50 (F304)
Course Credit Hours/ ECTS credits	(3+0+0) 3 / 5	**Pre-requisite/ Co-requisite**	CE 211
Level of Course	Sophomore	**Language of Instruction**	☑ English ☐ Turkish
Instructor(s) and office hours	Assoc. Prof. Dr. Aslı Numanoğlu Genç (asli.genc@tedu.edu.tr) (Rm. D301) (Office hours: By appointment)		
Teaching Assistant(s)	Res.Asst. Neslihan Pınar Gödek (npinar.godek@tedu.edu.tr) (Rm. F308) (Office hours: By appointment)		
Student Assistant(s)	-		
Textbook	-		
Recommended Textbooks	1. Munson, B.R., Okisihi, T.H., Huebsch, W.W. and Rothmayer, A.P. (2013). *Fundamentals of Fluid Mechanics.* 7th Edition, Wiley. 2. Potter, M.C., Wiggert D.C. and Ramadan B.H. (2012). *Mechanics of Fluids (SI version).* 4th Edition, Stamford, Cengage Learning Custom Publishing. 3. White, F. M. (2009). *Fluid Mechanics.* 7th Edition, New York, McGrawHill Education. 4. Cengel, Y. A. and Cimbala, J. M. (2013). *Fluid Mechanics: Fundamentals and Applications.* 3rd Edition, McGrawHill Education. 5. Elger, D. F., Williams, B. C., Crowe, C. T., & Roberson, J. A. (2014). *Engineering fluid mechanics*. 9th Edition, Wiley. 6. Nakayama, Y. and Boucher, B.F. (1999). Fluid Mechanics, Revised edition, Butterworth & Heineman. 7. Oertel, H. Introduction to Fluid Mechanics, Karlsruhe University, 2001.		
Course Web Pages	Please register to Moodle page http://moodle.tedu.edu.tr and regularly follow this link to have access to course materials.		

Course Description

Definitions, physical properties. Hydrostatics, forces on plane and curved surfaces, buoyancy, hydrostatics in moving and rotating containers. Lagrangian and Eulerian descriptions, derivatives, rate of deformation, flowlines. System and control volume approach, Reynolds transport theorem, principles of conservation of mass, momentum and energy, Bernoulli equation. Dimensional analysis, Buckingam pi theorem, similitude.

Course Objective

The aim of this course is to broaden students' horizon in the field of Fluid Mechanics; to increase students' ability to apply knowledge of mathematics, science and engineering; to increase students' ability to identify, formulate and solve problems in a systematic way; to increase students' ability to implement their theoretical knowledge.

Course Learning Outcomes

Upon successful completion of this course, a student specifically will be able to:

1. Recognize physical properties of fluids such as viscosity, density, specific weight, surface tension, vapor pressure, bulk modulus of elasticity of fluids and use them in basic fluid mechanics problems **[B1]**.
2. Understand the pressure distribution over the plane and curved surfaces and compute the hydrostatic forces acting on them **[B2]**.
3. Examine velocity and acceleration fields, formulate pathlines, streamlines and streaklines, express Eulerian and Lagrangian flow descriptions **[B4]**.
4. Identify gradient, divergence, and curl operations in solving fluid mechanics problems **[B1]**.
5. Interpret fluid element kinematics, employ vector calculus in the derivation of basic conservation equations, and recognize the physical interpretations of mathematical terms in complex equations **[B5]**.
6. Illustrate control volume analysis and analyze fluid mechanics problems that require the use of conservation of mass, momentum and energy principles **[B3]**.
7. Perform dimensional analysis and use similitude principles to identify the important quantities and/or dimensionless parameters in a given problem before attempting to do any analytical or experimental work on the subject matter, thus saving time, money and efforts **[B4]**.

Course Assignments

A. ***Homeworks (20 %):*** There will be four Homeworks assigned during the semester.
B. ***Mid-Terms (50%):*** There will be two Mid-Terms during the semester each having an equal weight.
C. ***Final Exam (30%***): There will be a comprehensive final during the final exam weeks. Exact date of the final will be announced by the University towards the end of the semester.

Course Assessments & Learning Outcomes Matrix

Table 1. Assessment Methods

Assessment Methods	Course Learning Outcomes
Homework 1	#1, #2 (Viscosity, Hydrostatics)
Homework 2	#3, #4, #5 (Velocity and acceleration fields, pathlines, streamlines)
Homework 3	#6 (Conservation of Mass, Momentum and Conservation of Energy)
Homework 4	#7 (Dimensional Analysis and Similutude)
Mid-Term 1	#1, #2, #3, #4, #5 (Viscosity, Hydrostatics, Velocity and acceleration fields, Pathlines, Streamlines)
Mid-Term 2	#6 (Reynolds Transport Theorem, Conservation of Mass, Conservation of Momentum, Conservation of Energy)
Final Exam	#1, #2, #3, #4, #5, #6, #7 (All chapters)

Relationship to Program Outcomes

This course contributes to fulfillment of the following program outcomes:
Comprehend science and advanced mathematics subjects fundamental to Engineering **[PO1].**
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].**
Identify, formulate, and solve engineering problems **[PO6].**

Course Outline

Week	Topic
1-2	**1. INTRODUCTION** 1.1. Definition of fluid 1.2. Scope of Fluid Mechanics 1.3. Concept of continuum 1.4. Physical properties of fluids
3-4-5	**2. HYDROSTATICS** 2.1. Stress at a point 2.2. Governing equation 2.3. Pressure distribution in an incompressible fluid at rest 2.4. Measurement of pressure 2.5. Hydrostatic forces on plane surfaces 2.6. Hydrostatic forces on curved surfaces 2.7. Buoyancy and floatation
6-7	**3. KINEMATICS** 3.1. Definition of kinematics 3.2. Velocity field 3.3. Acceleration field 3.4. Flow Lines 3.5. Types of Motion and Deformation 3.6. Classification of fluid flow **MID-TERM 1**
8-9-10-11-12	**4. BASIC PRINCIPLES AND METHODS OF ANALYSIS** 4.1- Laws of nature 4.2- System and control volume concepts (Reynolds transport theorem) 4.3- Conservation of mass principle 4.4- Conservation of momentum principle 4.5- Conservation of energy principle 4.6- Energy and hydraulic grade lines 4.7- Velocity coefficients **MID-TERM 2**
13-14	**5. DIMENSIONAL ANALYSIS AND SIMILITUDE** 5.1. Dimensional analysis 5.2. Buckingham's pi theorem 5.3. Basic dimensionless parameters in hydromechanics 5.4. Model similitude and principles of modeling

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 link: http://student.tedu.edu.tr/sites/default/files/content_files/2015-2016ogrencielkitabi.pdf

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, please see the following link: http://student.tedu.edu.tr/sites/default/files/content_files/2015-2016ogrencielkitabi.pdf

Disability Support

If you have a disabling condition which may interfere with your ability to successfully complete this module, please contact Dr. Onur Özmen (email: onur.ozmen@tedu.edu.tr). For more information please see Handbook for Registered Students.