

**TED UNIVERSITY**

**CE 232**

**Fluid Mechanics**

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**Course Syllabus / SPRING 2023**

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## Course Information

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<b>Required or Elective</b>	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective	<b>Date Prepared</b>	February 2023
<b>Semester</b>	Spring 2023	<b>Class Hours, Lab. Hours and Class-rooms</b>	Mon.: 12:00-13:00 (G201) Thurs.: 10:00-12:00 (G101)
<b>Course Credit Hours/ ECTS credits</b>	(3+0+0) 3 / 5	<b>Pre-requisite/ Co-requisite</b>	CE 211
<b>Level of Course</b>	Sophomore	<b>Language of Instruction</b>	<input checked="" type="checkbox"/> English <input type="checkbox"/> Turkish
<b>Instructor(s) and office hours</b>	Assoc. Prof. Dr. Asli Numanoğlu Genç (asli.genc@tedu.edu.tr) (Office: D301) (Office hours: By appointment)		
<b>Teaching Assistant(s)</b>	Res.Asst. Neslihan Pinar Gödek (npinar.godek@tedu.edu.tr) (Office: F308) (Office hours: By appointment)		
<b>Student Assistant(s)</b>	-		
<b>Textbook</b>	-		
<b>Recommended Textbooks</b>	<ol style="list-style-type: none"><li>1. Munson, B.R., Okisihi, T.H., Huebsch, W.W. and Rothmayer, A.P. (2013). <i>Fundamentals of Fluid Mechanics</i>. 7<sup>th</sup> Edition, Wiley.</li><li>2. Potter, M.C., Wiggert D.C. and Ramadan B.H. (2012). <i>Mechanics of Fluids (SI version)</i>. 4<sup>th</sup> Edition, Stamford, Cengage Learning Custom Publishing.</li><li>3. White, F. M. (2009). <i>Fluid Mechanics</i>. 7<sup>th</sup> Edition, New York, McGrawHill Education.</li><li>4. Cengel, Y. A. and Cimbala, J. M. (2013). <i>Fluid Mechanics: Fundamentals and Applications</i>. 3<sup>rd</sup> Edition, McGrawHill Education.</li><li>5. Elger, D. F., Williams, B. C., Crowe, C. T., &amp; Roberson, J. A. (2014). <i>Engineering fluid mechanics</i>. 9<sup>th</sup> Edition, Wiley.</li><li>6. Nakayama, Y. and Boucher, B.F. (1999). <i>Fluid Mechanics</i>, Revised edition, Butterworth &amp; Heineman.</li><li>7. Oertel, H. <i>Introduction to Fluid Mechanics</i>, Karlsruhe University, 2001.</li></ol>		
<b>Course Web Pages</b>	Please register to Moodle page <a href="http://moodle.tedu.edu.tr">http://moodle.tedu.edu.tr</a> and regularly follow this link to have access to course materials.		

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## Course Description

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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, Buckingham pi theorem, similitude.

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## Course Objective

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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.

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## Course Learning Outcomes

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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].

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## Course Assignments

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- A. **Quizzes (28%)**: There will be two quizzes during the semester each having an equal weight.
- B. **Homeworks (32%)**: There will be four homeworks during the semester each having an equal weight.
- C. **Final Exam (40%)**: 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.

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## Course Assessments & Learning Outcomes Matrix

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**Table 1. Assessment Methods**

Assessment Methods	Course Learning Outcomes
Quiz 1	#1, #2, #3, #4, #5 (Viscosity, Hydrostatics, Velocity and acceleration fields, Pathlines, Streamlines)
Quiz 2	#6 (Reynolds Transport Theorem, Conservation of Mass, Conservation of Momentum, Conservation of Energy)
Homeworks	#1, #2, #3, #4, #5, #6, #7 (All chapters)
Final Exam	#1, #2, #3, #4, #5, #6, #7 (All chapters)

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## Relationship to Program Outcomes

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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].

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## Course Outline

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Week	Topic
1-2	<b>1. INTRODUCTION</b> 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	<b>2. HYDROSTATICS</b> 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	<b>3. KINEMATICS</b> 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
8-9-10-11-12	<b>4. BASIC PRINCIPLES AND METHODS OF ANALYSIS</b> 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 <b>MID-TERM 2</b>
13-14	<b>5. DIMENSIONAL ANALYSIS AND SIMILITUDE</b> 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/2015-2016ogrencielkitabı.pdf](http://student.tedu.edu.tr/sites/default/files/content_files/2015-2016ogrencielkitabı.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/2015-2016ogrencielkitabı.pdf](http://student.tedu.edu.tr/sites/default/files/content_files/2015-2016ogrencielkitabı.pdf).

## **STUDENT SERVICES INFO:**

### **o Student Development and Psychological Counseling Center:**

The Center is a service mandated with providing crisis intervention and supportive listening services to the campus community. A major part of fulfilling that mandate is raising awareness of our service so students know they are never alone in dealing with problems. You may contact the SDPCC at: [ogrencidanismamerkezi@tedu.edu.tr](mailto:ogrencidanismamerkezi@tedu.edu.tr), 0312 585 0316, Office A122, Or visit their website at <http://csc.tedu.edu.tr/>

### **o TEDU COPeS - Psycho-Social Support**

TED University Psychosocial Support Team was initially established in order to facilitate coping with the psychological, social, familial, academic, and professional difficulties that may arise due to adverse conditions associated with COVID-19 pandemic for TEDU students and employees.

In time we have expanded our services to provide psychosocial support in diverse disasters. In this line, TEDU COPeS offers psychosocial support for TED University students and employees in the aftermath of Kahramanmaraş earthquakes.

For further information and/or questions, visit their website at <https://copes.tedu.edu.tr/>.

### **o Specialized Support and Students with Disabilities**

Students who may require specialized support due to a disability affecting mobility, vision, hearing, learning, mental or physical health should consult with Specialized Support and Disability Coordinator, Asst. Prof. Emrah Keser E-mail: [emrah.keser@tedu.edu.tr](mailto:emrah.keser@tedu.edu.tr), or visit the website at <https://www.tedu.edu.tr/tr/main/engelsiz-tedu>.