TED UNIVERSITY

ME353 Fluid Mechanics Syllabus

Instructor: Dr. Özgür Uğraş BARAN

Fall 2016

COURSE INFORMATION

Basic Information	
Required or elective	Required
Course Credit (Hours/ECTS credits)	(3-0-0/6)
Class Hours and Classrooms	Tuesday 12:00-14:00 and Thursday 16:00-17:00 at G006
Level of Course	
Instructor	Dr. Özgür Uğraş BARAN (e-mail: ozgur.baran@tedu.edu.tr)
Office Hours	Thursdays 14:00-16:00 or by appointment
Textbook	Fluid Mechanics SI Version (7th ed.) by Munson, Okiishi, Huebsch, Rothmayer, Wiley

Course Description

Fundamental principles of fluid mechanics and their application to engineering problems. Fluid statics. Fluid flow concepts. Control-volume analysis. Conservation equations and applications. Dimensional analysis and similitude. Flow of viscous fluids, simple laminar flow systems, turbulence, internal and external flow applications.

Objectives

Mechanics is the physical science that deals with the effects of forces on objects. Mechanics can be divided into three main branches: rigid-body mechanics, deformable-body mechanics, and fluid mechanics. This course is an introductory level course on fluid mechanics.

Course Learning Outcomes

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

1. Recognize physical properties of fluids and use them in basic fluid mechanics problems, convert units, examine dimensional homogeneity in expressions

2. Analyze fluid static problems and examine pressure measurement setups

3. Recognize difference of dynamic and total pressures, apply Bernoulli's equation to fluid mechanics problems without energy loss.

4. Examine velocity and acceleration fields, formulate pathlines, streamlines and streaklines, express Eulerian and Lagrangian flow descriptions.

5. Illustrate control volume analysis and analyze fluid mechanics problems that require the use of conservation of mass, momentum and energy principles

6. Interpret fluid element kinematics, employ vector calculus in the derivation of basic conservation equations, recognize the physical interpretations of mathematical terms in complex equations.

7. Perform dimensional analysis, recognize common dimensionless groups, apply Buckingham Pi theorem to model studies

COURSE PLAN AND POLICIES

✳ The course schedule is tentative and it will be adapted to the pace of the class.

✳ There will be three midterm exams. Midterm weeks are given in the tentative schedule and they are subject to change.

✳ Date for the final exam will be announced at the end of the semester. The final exam will cover all topics.

✳ Make-up exams will be given only for medical excuses documented by medical reports that are approved by the Student Health Center of TEDU or other documented excuses approved by executive branches to TEDU. All make-up exams will be given after the final exam.

✳ The dates for Make-up exams for Finals are decided by Make-up Exam Commission according to the rules and regulation of TEDU. Please see the link http://www.tedu.edu.tr/en-US/Content/Default.aspx?SectionID=114 .

✳ You may use a scientific calculator during the exams. Programming the calculator before or during the exams are not allowed.

✳ You are not allowed to use cell phones during the exams.

✳ You are expected to attend on all classes. Classes start on the hour. Please be respectful to your class mates by being on time.

✳ 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.

Homework Policy

There will be computer based homework during the semester. You are supposed to submit all homework. Late submission is not allowed by the homework assignment system. Homework system assigned by the code given with the course book. Grading method given below is tentative, but note that there will be no reduction on the percentage of the homework. Therefore, please take it seriously!

Some homework will contain preparatory material for the next lecture. For a fruitful course, please be on time.

Course assessment and learning outcomes matrix

Assessment Method	Course learning outcome
Homeworks	#1,#2,#3,#4,#5,#6,#7
Midterm 1	#1,#2
Midterm 2	#3,#4
Midterm 3	#5,#6
Final	#1,#2,#3,#4,#5,#6,#7

Grading

The tentative grading method is given below.

Method	%
Homeworks	10%
Midterm 1	20%
Midterm 2	20%
Midterm 3	20%
Final	30%

Tentative Schedule

Week	

1	1. Properties of fluids
	  1.1. Some Characteristics of Fluids
	  1.2. Dimensions, Dimensional Homogeneity, and Units
	  1.3. Analysis of Fluid Behavior
	  1.4. Measures of Fluid Mass and Weight
	  1.5. Ideal Gas Law
	  1.6. Viscosity
	  1.7. Compressibility of Fluids
	  1.8. Vapor Pressure
	  1.9. Surface Tension

Week	
2	2. Fluid Statics 2.1. Pressure at a Point 2.2. Basic Equation for Pressure Field 2.3. Pressure Variation in a Fluid at Rest 2.4. Standard Atmosphere 2.5. Measurement of Pressure 2.6. Manometry 2.7. Mechanical and Electronic Pressure Measuring Devices 2.8. Hydrostatic Force on a Plane Surface
3	2.9. Pressure Prism 2.10. Hydrostatic Force on a Curved Surface 2.11. Buoyancy, Flotation, and Stability 2.12. Pressure Variation in a Fluid with Rigid-Body Motion **MIDTERM EXAM**
4	3. Bernoulli Equation 3.1. Newton's Second Law 3.2. F = ma Along a Streamline 3.3. F = ma Normal to a Streamline 3.4. Physical Interpretation 3.5. Static, Stagnation, Dynamic, and Total Pressure
5	3. Bernoulli Equation 3.6. Examples of Use of the Bernoulli Equation 3.7. The Energy Line and the Hydraulic Grade Line 3.8. Restrictions on Use of the Bernoulli Equation
6	4. Fluid Kinematics 4.1. The Velocity Field 4.2. The Acceleration Field
7	4. Fluid Kinematics 4.3. Control Volume and System Representations 4.4. The Reynolds Transport Theorem **MIDTERM EXAM**
8	5. Finite Control Volume Analysis 5.1. Conservation of Mass—The Continuity Equation 5.2. Newton's Second Law—The Linear Momentum and Moment-of-Momentum Equations
9	5. Finite Control Volume Analysis 5.3. First Law of Thermodynamics—The Energy Equation 5.4. Second Law of Thermodynamics—Irreversible Flow

Week	
10	6. Differential Analysis Of Fluid Flow 6.1. Fluid Element Kinematics 6.2. Conservation of Mass
11	6. Differential Analysis Of Fluid Flow 6.3. Conservation of Linear Momentum 6.4. Inviscid Flow
12	**MIDTERM EXAM** 7. Similitude, Dimensional Analysis, And Modeling 7.1. Dimensional Analysis 7.2. Buckingham Pi Theorem 7.3. Determination of Pi Terms
13	7. Similitude, Dimensional Analysis, And Modeling 7.4. Some Additional Comments About Dimensional Analysis 7.5. Determination of Pi Terms by Inspection 7.6. Common Dimensionless Groups in Fluid Mechanics 7.7. Correlation of Experimental Data 7.8. Modeling and Similitude
14	7. Similitude, Dimensional Analysis, And Modeling 7.9. Some Typical Model Studies 7.10. Similitude Based on Governing Differential Equations **REVIEW**

ETHICS

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.

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://www.tedu.edu.tr/Assets/Documents/News/Public/TEDU_Ogrenci_El_Kitabi_2012.pdf