MENG353 – Fluid Mechanics

Eastern Mediterranean University
Faculty of Engineering

Department: Mechanical Engineering

Program Code: 23	**Program:** Mechanical Engineering	**Year/Semester:** 2021-2022 Spring
Course Code: MENG353	**Course Title:** Fluid Mechanics	**Credit hours**

Lec.	**Tut**	**Lab/Activity**	**Total**
4	**0**	**1**	**4**

Type of Course
- ☒ Engineering or Area Core
- ☐ Engineering Course offered by other programs
- ☐ Engineering or Area Elective
- ☐ Mathematics and Basic Sciences
- ☐ General Education

Hourly Contribution
- ☐ Basic Science (-)
- ☐ College-level Mathematics (-)
- ☐ Complex Engineering Problems (-)
- ☒ Engineering Design (1)
- ☒ Engineering Science (3)
- ☐ Team (-)

Criterion 5 Subject Area:
- ☐ (a) College-level mathematics and basic sciences with experimental experience appropriate to the program.
- ☒ (b) Engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.
- ☒ (c) a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives.
- ☐ (d) a culminating major engineering design experience that
  - ☒ 1) Incorporates appropriate engineering standards and multiple constraints
  - ☐ 2) Based on the knowledge and skills acquired in earlier course work.

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Course Web Page: https://staff.emu.edu.tr/devrimaydin/en

Textbook(s):
Y. A. Çengel and J. M. Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw-Hill, 2006.

Catalog Description: This course is an introduction to fluid mechanics, and emphasizes fundamental concepts and problem-solving techniques. Topics to be covered include fluid properties, fluid statics, fluid kinematics, control volume analysis, dimensional analysis, internal flows (pipe flows), differential analysis (including approximations such as creeping flow, potential flow, and boundary layers), and external flows (lift and drag). If time permits, brief introductions to computational fluid dynamics (CFD) and turbomachinery (pumps and turbines) will be provided.

Prerequisite(s)	MATH201

Student Outcomes		
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	☒
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	☒
3	an ability to communicate effectively with a range of audiences	☐
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	☐
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	☐
6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	☒
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	☐

Course Learning Outcomes		Student Outcomes							Assessment Percentages
		1	2	3	4	5	6	7	
1	Introduction to the fundamental concepts of fluid mechanics.	X							Midterm Exam: 25% Final Exam: 35% Project: 10% Lab. Works: 15% Quizzes: 15%
2	To be able to solve problems involving fluid properties and shear forces resulting from Newtonian fluids.	X							
3	Pressure and Fluid Statics. To be able to calculate the magnitude and location of hydrostatic forces on flat plates and curved surfaces.	X							
4	Fluid kinematics, Lagrangian and Eulerian description of fluid flow. Materials derivative, four fundamental kinematic properties of fluid motion and deformation- rate of translation, rate of rotation, linear strain rate, and shear strain rate. Understanding the usefulness of RTT.	X							
5	Brief introduction to differential analysis of fluid motion followed by application to incompressible inviscid flow. To be able to assess the validity of Bernoulli's Equation for various fluid systems. To be able to determine the pertinent fluid properties from measurements taken by a pitot tube. Energy equation and head loss.	X					X		
6	Identify the various kinds of forces and moments acting on a control volume. Reviewing Newton's Laws of Motion. Use control volume analysis to determine the forces associated with fluid flow. Use control volume analysis to determine the moments caused by fluid flow and the torque transmitted. Performing linear and angular momentum analysis on fluid flow systems.	X					X		
7	Dimensional analysis and similitude. To understand the common dimensionless numbers of fluid mechanics and to be able to model fluid systems. Be able to evaluate the physical and mathematical significance of dimensionless numbers.	X							
8	Internal incompressible viscous flow. To be able to analyze flow through a single path and simple multipath pipe systems. Be able to explain the physical relationship between the various parameters in a piping system. pump efficiency; pump and system head: total head, suction head, discharge head, NPSH head; pump capacity, pump horsepower; parameters involved In Pump selection	X	X				X		
	Weight of Student Outcomes	**H**	**M**				**M**		

Topics Covered and Class Schedule:	
Week 1	Introduction to Basic concepts
Week 2	Pressure and Fluid Statics
Week 3	Fluid kinematics
Week 4 - 5	Mass, Bernoulli and Energy equations
Week 6 - 7	Momentum analysis of flow systems
Week 8 - 9	**Midterm Examination**
Week 10	Dimensional analysis and Modeling
Week 11-13	Flow in pipes
Week 14	Introduction to Computational Fluid Dynamics
Week 15-16	**Final Examination**

Lab. Work				
No.	**Experiment Title and Equipment Used**	**CLO**	**SO**	**Percentage**
1	**Title**: Impact of jet **Equipment:** Impact of jet apparatus	6	1, 6	5%
2	**Title:** Flow through venturi meter **Equipment:** Venturi meter	5	1,6	5%
3	**Title:** Major and minor Pipe losses **Equipment:** Fluid friction apparatus	8	1,6	5%
Project				
1	Design of cold water system for a building	8	1,2	10%

Important Notes Regarding the Course: University rules and regulations are applied to this course. For details, please see http://mevzuat.emu.edu.tr

Exam and Quiz Policy:

The midterm and final exams are OPEN book.

Quizzes: There will be a number of announced/unannounced quizzes during the semester. Students are expected to be ready to take a quiz any time they have a class.

Makeups:

1. There is no make-up or resit for the Quiz and Labs.
2. A student who fails to sit for an examination for a valid reason is given a make-up exam. Within three working days after the examination, students who wish to take a make-up must submit a **written statement** to the course instructor explaining the reason(s) for his/her request.
3. Eligibility to take a **Make-Up Exam**:
   a. Student must contact the Instructor immediately within "**three working days**" after the examination when (s)he has missed the mid-term exam or final exam and to discuss with the faculty about the date and time to take the make-up exam.
   b. Student must secure a "**Make-Up Exam Form**" from the department Office or from instructor website & fill-out the Form. For each Make-Up Exam, please use separate Form.
   c. Student must secure the approval from the instructor for taking the Make-Up Exam.
   d. Failure to take the Make-Up Exam at the agreed date and time will lead to a "NG" Grade for the Make-Up Exam, midterm or final.

NG Policy:

1. **"NG" Nil Grade/ Failing from Absenteeism:** Students who do not comply with the required level attendance and/or not fulfilling the requirements for the evaluation of the course are given the "NG" grade by the Instructor of the Course based on the criteria determined by the Faculty/School Academic Council. Students are informed about the criteria for receiving the "NG" grade by the related course instructor at the beginning of the semester. "NG" grade is included in the computation of GPA and CGPA.
2. Student attendance is monitored and assessed by the course instructor. A student who fails to meet the requirements of a course or who is absent more than the limit specified by the Faculty is considered to be unsuccessful in that course.
3. Students who do not attend any of the above assessment activities (such as mid-term exam, final exam, lab exam, design project report etc.) will be given NG (Nil Grade).

4. Late Submissions of the Assignments, Lab Reports and Project will be graded as zero.

Ethics

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. If you do not obey ethical rules disciplinary action will be taken as appropriate.

Notes on Homework Problems

• Homework (HW) problems are an essential element of this course.

• Students are encouraged to discuss the general principles involved in the homework sets with one another, but the detailed solution of each problem should be completed individually. Submitting a HW solution that is directly copied from another source is considered a violation of the honesty policy.

• Before solving a problem, students should draw a schematic of the physical problem to be considered and think about the appropriate assumptions and mathematical formulation for the basic laws that you consider necessary for solutions.

Important Notes:

Late submission of Homework or Project will not accepted and evaluated.

Appeals:

Any appeal against the marks of any assessment component must be made to the course instructor within ***three days*** following the announcement of the marks. Any appeal concerning a semester grade must be made to the course instructor no later than within ***one week*** after the announcement of the grades.

Prepared by: Asst. Prof. Dr. Devrim Aydin

Date Prepared: 25.02.2022