COURSE PROFILE

Course Name	Code	Semester	Term	Theory +PS+Lab. (hour/week)	Local Credits	ECTS
Mathematical Theory of Fluids	MATH 451	Fall	7	3+0+0	3	6

Prerequisites	None

Course Language	English
Course Type	Elective
Course Lecturer	• Prof.Dr. Hilmi Demiray
Course Assistant	--
Course Objectives	The aim of this course is to present a mathematical model for fluids and then solve these model equations under the effect of external agencies.
Course Learning Outcomes	The students who succeeded in this course; • will be able to characterize the behaviour of a fluid body by a mathematical expression (mathematical modelling). • will be able to understand the physical characterization of various differential equations. • will be able to characterize some phenomenon existing in the nature by some mathematical formulas and interpret the resulting solution. • will be able to understand the origin of some phenomenon like sound and its propagation as a wave.
Course Content	Mathematical preliminaries, definitions, kinematics of fluids. Material derivative, velocity and acceleration vectors. Path and flow lines, vortex, equations of motion, stress. Constitutive equations, hydrostatics. Ideal fluids, Bernoulli theorems, incompressible ideal fluids. Potential flows, vortex flows, surface waves, viscous flids, Stokes approximations, boundary layer theory.

COURSE CONTENT

Week	Subjects	Related Preparation
1	Definitions and classification of fluids, mathematical preliminaries, vectors and tensors, gradient of scalars and vectors.	Chapter 1, 2

2	Curvilinear coordinates, cylindrical and spherical coordinates, integral theorems, Green- Gauss theorems, Stokes theorems.	Chapter 2
3	Kinematics of fluids: motion, material derivative, and acceleration vectors, path and flow lines, velocity field around a point: deformation rate and vorticity tensors.	Chapter 3
4	Transport theorems, jump conditions, Balance laws: conservation of mass, balance of linear and angular momenta, balance of energy, stress at a point, stress tensor.	Chapter 4
5	Moving coordinate systems, circulation, constitutive equations, Helmholtz resolution theorem, ideal fluids, viscous fluids, equations of ideal fluids in various coordinate systems.	Chapter 4
6	Bernoulli's theorems, incompressible ideal fluids, flows in two dimension, axially symmetric flows.	Chapter 4, 6
7	Potential flows. Midterm I.	Chapter 6
8	Potential flow (continued), sphere in a uniform flow.	Chapter 6
9	Sphere in rectilinear motion, plane potential flows.	Chapter 6
10	Uniform plane flows, source and sink problems.	Chapter 6
11	The use of complex functions in solving plane flow problems.	Chapter 6
12	Blausius theorems, Blausius theorems for a cylinder in motion, theorem for a circular disc.	Chapter 6
13	Blausius theorems and applications (continued). Midterm II.	Chapter 6
14	Conform mapping and its applications to plane flow.	Chapter 6

Course Textbooks	Fluid Mechanics, 3rd Edition, Pijush K. Kunda and Ira M. Cohen, Elsevier Academic Press, 2004.
Recommended References	Any book on fluid dynamics.

Semester Requirements	**Number**	**Percentage of Grade**

Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Special Course Internship (Work Placement)	-	-
Quizzes/Studio Critics	-	-
Homework Assignments	7	10
Presentation	-	-
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	1	40
Final/Resit Exam	1	50
Total	9	100

PERCENTAGE OF SEMESTER WORK	8	50
PERCENTAGE OF FINAL WORK	1	50
Total	9	100

Course Category	Core Courses	X
	Major Area Courses	
	Supportive Courses	
	Media and Management Skills Courses	
	Transferable Skill Courses	

COURSE'S CONTRIBUTION TO PROGRAM

#	**Program Qualifications / Outcomes**	*** Level of Contribution**				
		1	2	3	4	5
1	To have a grasp of basic mathematics, applied mathematics and theories and applications of statistics.					X
2	To be able to use theoretical and applied knowledge acquired in the advanced fields of mathematics and statistics,					X

3	To be able to define and analyze problems and to find solutions based on scientific methods,					X
4	To be able to apply mathematics and statistics in real life with interdisciplinary approach and to discover their potentials,					X
5	To be able to acquire necessary information and to make modeling in any field that mathematics is used and to improve herself/himself,					X
6	To be able to criticize and renew her/his own models and solutions,					X
7	To be able to tell theoretical and technical information easily to both experts in detail and nonexperts in basic and comprehensible way,			X		
8	To be able to use international resources in English and in a second foreign language from the European Language Portfolio (at the level of B1) effectively and to keep knowledge up-to-date, to communicate comfortably with colleagues from Turkey and other countries, to follow periodic literature,				X	
9	To be familiar with computer programs used in the fields of mathematics and statistics and to be able to use at least one of them effectively at the European Computer Driving Licence Advanced Level,			X		
10	To be able to behave in accordance with social, scientific and ethical values in each step of the projects involved and to be able to introduce and apply projects in terms of civic engagement,			X		
11	To be able to evaluate all processes effectively and to have enough awareness about quality management by being conscious and having intellectual background in the universal sense,			X		
12	By having a way of abstract thinking, to be able to connect concrete events and to transfer solutions, to be able to design experiments, collect data, and analyze results by scientific methods and to interfere,				X	
13	To be able to continue lifelong learning by renewing the knowledge, the abilities and the compentencies which have been developed during the program, and being conscious about lifelong learning,					
14	To be able to adapt and transfer the knowledge gained in the areas of mathematics and statistics to the level of secondary school,			X		
15	To be able to conduct a research either as an individual or as a team member, and to be effective in each related step of the project, to take role in the decision process, to plan and manage the project by using time effectively.					

*1 Lowest, 2 Low, 3 Average, 4 High, 5 Highest

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Number	Duration (Hours)	Total Workload
Course Hours (Including Exams)	14	3	48
Tutorials	-	-	-
Laboratory	-	-	-
Application	-	-	-
Special Course Internship (Work Placement)	-	-	-
Field Work	-	-	-
Study Hours Out of Class	14	2	28
Presentations / Seminar	-	-	-
Project	-	-	-
Preparatory reading	13	2	26
Homework Assignments	7	3	21
Quizzes	-	-	-
Midterm Exams	1	9	9
Final / Resit Exam	1	18	18
		Total Workload	**150**

COURSE CATEGORY

ISCED GENERAL AREA CODES	GENERAL AREAS	ISCED BASİC AREA CODES	BASIC EDUCATIONAL AREAS	
1	Education	14	Teacher Training and Educational Sciences	0
2	Humanities and Art	21	Art	0
2	Humanities and Art	22	Humanities	0
3	Social Sciences, Management and Law	31	Social and Behavioral Sciences	0
3	Social Sciences, Management and Law	32	Journalism and Informatics	0

3	Social Sciences, Management and Law	38	Law	0
4	Science	42	Life Sciences	0
4	Science	44	Natural Sciences	0
4	Science	46	Mathematics and Statistics	70
4	Science	48	Computer	0
5	Engineering, Manufacturing and Civil	52	Engineering	30
5	Engineering, Manufacturing and Civil	54	Manufacturing and Processing	0
5	Engineering, Manufacturing and Civil	58	Architecture and Structure	0
6	Agriculture	62	Agriculture, Forestry, Livestock, Fishery	0
6	Agriculture	64	Veterinary	0
7	Medicine and Welfare	72	Medical	0
7	Medicine and Welfare	76	Social Services	0
8	Service	81	Personal Services	0
8	Service	84	Transport Services	0
8	Service	85	Environment Protection	0
8	Service	86	Security Services	0