ÇANKAYA UNIVERSITY
Graduate School of Natural and Applied Sciences
New Course Proposal Form

This form should be used for either an elective or a compulsory course being proposed and curricula development processes for a graduate curriculum at Çankaya University, Graduate School of Natural and Applied Sciences. Please fill in the form completely and submit the printed copy containing the approval of the Director of Institute. Upon the receipt of the form, it will be forwarded to the Academic Board for approval. Incomplete forms will be returned to the Department. The approved form is finally sent to the President's office for approval by the Senate.

Part I. Basic Course Information

Department Name	MECHANICAL ENGINEERING					**Dept. Numeric Code**	87
Course Code	ME 516	**Number of Weekly Lecture Hours**	3	**Number of Weekly Lab/Tutorial Hours**	0	**Number of Credit Hours**	3
Course Web Site	http:// me516.cankaya.edu.tr					**ECTS Credit**	0 7.5

Course Name *This information will appear in the printed catalogs and on the web online catalog.*	
English Name	Advanced Fluid Mechanics
Turkish Name	İleri Akışkanlar Mekaniği

Course Description
Provide a brief overview of what is covered during the semester. This information will appear in the printed catalogs and on the web online catalog. Maximum 60 words.

Introduction to fluid mechanics. Scalar, vector and tensor analysis. Definition of continuum. Lagrange and Eulerian description of fluid motion. Reynolds transport theorem. Kinematics of fluid motion; streamline, streakline, pathline and timeline; vorticity, circulation, rotation and deformation. Fundamental equations and constitutive relations; derivation of differential continuity, momentum and energy equations. Solution of simple viscous flow problems. Potential flows. Application of complex functions to two-dimensional potential flows. Conformal mapping.

Prerequisites (if any) *Give course codes and check all that are applicable.*	1st	2nd	3rd	4th
	☐ Consent of the Instructor	☐ Senior Standing	☐ Give others, if any.	
Co-requisites (if any)	1st	2nd	3rd	4th
Course Type *Check all that are applicable*	☐ Must course for dept.	☐ Must course for other dept.(s)	☒ Elective course for dept.	☐ Elective course for other dept.(s)

Course Classification
Give the appropriate percentages for each category.

Category	Mathematics & Natural Sciences	Engineering Sciences	Engineering Design	General Education	Other
Percentage	35	40	25		

Part II. Detailed Course Information

Course Objectives
Explain the aims of the course. Maximum 100 words.

To introduce the basic properties of fluids and importance of fluid mechanics in engineering applications. Introduce the basic approaches and derive the basic equations in differential form and apply them to engineering problems involving fluids.

Learning Outcomes
Explain the learning outcomes of the course. Maximum 10 items.

1. Knowledge about the basic properties of fluids and flows, and the basic laws and principles related the fluid flows.
2. Ability to derive the basic equations in differential form used for flow analysis.
3. Ability to solve the basic equations for simple flow problems and interpret the results.
4. Ability to derive equations of inviscid flow and apply for the analysis.

Textbook(s)
List the textbook(s), if any, and other related main course materials.

Author(s)	Title	Publisher	Publication Year	ISBN
I. G. Curie	Fundamental Mechanics of Fluids	McGraw-Hill Book Company	1974	0-07-014950-X

Reference Books
List the reference books as supplementary materials, if any.

Author(s)	Title	Publisher	Publication Year	ISBN
R. W. Fox, A. T. McDonald, P. J. Pritchard and J. W. Mitchell	Fluid Mechanics	John Wiley & Sons., Inc	2016	978-1-118-96127-8
Donald F. Young, Bruce R. Munson, Theodore H. Okiishi and Wade W. Huebsch	Introduction to Fluid Mechanics,	John Wiley & Sons, Inc	2012	978-0-470-90215-8

Teaching Policy
Explain how you will organize the course (lectures, laboratories, tutorials, studio work, seminars, etc.)

Three hour lecture per week and homework

Laboratory/Studio Work
Give the number of laboratory/studio hours required per week, if any, to do supervised laboratory/studio work, and list the names of the laboratories/studios in which these sessions will be conducted.

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Computer Usage
Briefly describe the computer usage and the hardware/software requirements in the course.

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Course Outline
List the topics covered within each week.

Week	Topic(s)
1	**INTRODUCTION**: Definitions, scalar, vector and tensor analysis.
2	**BASIC LAWS**: Conservation of mass, Newton's laws, the first law of thermodynamics.
3	**DERIVATION OF BASIC EQUATIONS**: Constitutive relations, governing equations for laminar flows, boundary conditions.
4	**DERIVATION OF BASIC EQUATIONS**: Governing equations for turbulent flows, turbulence models.
5	**ANALYSIS OF VISCOUS FLOWS**: Solution of simple viscous flow problems (Couette Flow, Hagen-Poiseuille flow).
6	**ANALYSIS OF VISCOUS FLOWS**: Solution of simple viscous flow problems.
7	**KINEMATICS OF FLUID MOTION**: Streamline, streakline, pathline and timeline; vorticity, circulation, fluid rotation and deformation.
8	**INVISCID FLOW**: Derivation of basic equations of inviscid flow. Complex functions, complex potential, complex velocity.
9	**INVISCID FLOW**: Elementary plane flows: uniform flow, source flow, sink flow, vortex flow, and doublet.
10	**INVISCID FLOW**: Superposition of elementary plane flows.
11	**INVISCID FLOW**: Derivation and application of Blasius laws.
12	**INVISCID FLOW**: Derivation and application of Blasius laws.
13	**INVISCID FLOW**: Conformal transformation, Joukowski transformation, Schwarz-Crhristofell transformation.
14	**INVISCID FLOW**: Analysis of flow over ellipse and airfoils.

Grading Policy
List the assessment tools and their percentages that may give an idea about their relative importance to the end-of-semester grade.

Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage
Homework			Case Study			Attendance		
Quiz	4	15	Lab Work			Field Study		
Midterm Exam	1	35	Class Participation			Project		
Term Paper	1	10	Oral Presentation			Final Exam	1	40

ECTS Workload
List all the activities considered under the ECTS.

Activity	Quantity	Duration (hours)	Total Workload (hours)
Attending Lectures (*weekly basis*)	14	3	42
Attending Labs/Recitations (*weekly basis*)			
Preparation beforehand and finalizing of notes (*weekly basis*)	14	2	28
Collection and selection of relevant material (*once*)	1	8	8
Self-study of relevant material (*weekly basis*)	14	3	42
Homework assignments			

Preparation for Quizzes	4	5	20
Preparation for Midterm Exams (*including the duration of the exams*)	1	15	15
Preparation of Term Paper/Case Study Report (*including oral presentation*)	1	20	20
Preparation of Term Project/Field Study Report (*including oral presentation*)			
Preparation for Final Exam (*including the duration of the exam*)	1	15	15
TOTAL WORKLOAD / 25			190/25
ECTS Credit			**7.5**

Total Workloads are calculated automatically by formulas. To update all the formulas in the document first press CTRL+A and then press F9.

Program Qualifications vs. Learning Outcomes

Consider the below program qualifications determined in terms of learning outcomes of all the courses in the curriculum and capabilities. Look at the learning outcomes of this course given above. Relate these two using the Likert Scale by marking with X in one of the five choices at the right..

No	Program Qualifications	Contribution				
		0	1	2	3	4
1	Adequate knowledge in mathematics and engineering subjects pertaining to Mechanical Engineering; ability to apply theoretical and practical mathematical skills to complex engineering problems in the area.			X		
2	Have comprehensive knowledge about current techniques and methods applied in mechanical engineering; ability to apply these techniques to complex mechanical engineering problems.				X	
3	Ability to define and formulate problems related to Mechanical Engineering area, develop methods to solve them, and apply innovative techniques in solutions.				X	
4	Ability to select and use modern techniques and tools required to analyze and solve complex problems encountered in Mechanical Engineering; ability to use information technologies effectively.					X
5	Ability to design complex systems or processes and develop innovative alternatives.	X				
6	Ability to design and conduct experiments, gather data, analyze and interpret results for investigation of complex problems related to Mechanical Engineering.	X				
7	Ability to work independently and in teams and lead a team.				X	
8	Knowledge of at least one foreign language (English in particular) at least at the B2 level of the European Language Portfolio; ability to write reports, ability to give and receive clear and intelligible instructions.		X			
9	Ability to communicate processes and results of studies systematically and clearly in written and oral form in national and international environments.			X		
10	Awareness about the need for life-long learning; ability to access information, ability to keep abreast of the latest developments in science and technology, ability to continuously stay up to date.			X		
11	Awareness about the social, scientific, and ethical values in the stages of data collection, discussion, presentation and in all professional activities.			X		

Contribution Scale to a Qualification: **0**-None, **1**-Little, **2**-Medium, **3**-Considerable, **4**-Largest

Part III New Course Proposal Information

State only if it is a new course

Is the new course **replacing** a former course in the curriculum**?**	Yes ☐	No ☒	Former Course's Code	Former Course's Name
Is there any similar course which has content **overlap** with other courses offered by the university**?**	Yes ☐	No ☒	Most Similar Course's Code	Most Similar Course's Name
Frequency of Offerings *Check all semesters that the course is planned to be offered.*	☒ Fall	☐ Spring	☐ Summer	
First Offering	Academic Year	2016/2017	Semester ☒ Fall	☐ Spring
Maximum **Class Size** Proposed	25	Student **Quota** for Other Departments	10	Approximate **Number of Students** Expected to Take the Course: 15

Justification for the proposal

Maximum 80 words

This lecture is proposed to enhance the students' knowledge and ability on formulating and solving the flow problems.

Part IV Approval

	Faculty Member *Give the Academic Title first.*	Signature	Date
Proposed by	Prof. Dr. Haşmet TÜRKOĞLU		17.09.2021

Departmental Board Meeting Date	Prof. Dr. Haşmet TÜRKOĞLU	Meeting Number		Decision Number	
Department Chair		Signature		Date	

Meeting Date		Meeting Number		Decision Number	
Director of Institute	Assoc. Prof. Dr. Ziya ESEN	Signature		Date	

Senate Meeting Date		Meeting Number		Decision Number	