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 654	**Number of Weekly Lecture Hours**	3	**Number of Weekly Lab/Tutorial Hours**	0	**Number of Credit Hours**	3
Course Web Site	http:// me654.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	Computational Fluid Dynamics
Turkish Name	Hesaplamalı Akışkanlar Dinamiği

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.

Nature of numerical methods. Advantages and disadvantages of numerical methods. Classification of fluid flow phenomena. Fundamental flow equations. Basic steps of numerical methods. Discretization methods. Solution of linear algebraic equation systems. Solution of convection-diffusion problems using control volume formulation. Computational methods for incompressible Navier-Stokes equations: Primitive and vorticity-based methods, SIMPLE, SIMPLER, SIMPLEC and PISO algorithms.

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	30	40	30		

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Part II. Detailed Course Information

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

Introduce the basic features and importance of numerical methods used for the flow analysis. Formulate and implement some of these methods for simulation of simple flows.

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

1. Knowledge about basic numerical methods used for the analysis of flows
2. Knowledge about the basic tasks performed in computational analysis of flow problems
3. Ability to choose and apply proper numerical methods for a given flow problem
4. Ability to numerically analyze flow problems and interpret the numerical results.

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

Author(s)	Title	Publisher	Publication Year	ISBN
H. K. Versteeg and W. Malalasekera	An Introduction to Computational Fluid Dynamics	Prentice Hall	1995	0-582-21884-5

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

Author(s)	Title	Publisher	Publication Year	ISBN
S. V. Patankar	Numerical Heat Transfer and Fluid Flow	Hemisphere Publishing Corporation	1980	0-89116-522-3

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

Three hours 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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For the assigned homework problems and software developed by students and/or commercial software, computers are used.

Course Outline
List the topics covered within each week.

Week	Topic(s)
1	Basic Definitions, Methods for the Analysis of Flows, Classification of Flows, Basic Laws and Basic Equations.
2	Equation of Conservation of Mass, Momentum (Navier-Stokes Equation) and Energy.
3	Introduction to Finite Difference, Control Volume, Finite Element Methods.
4	Solution of Algebraic Equations. Direct Methods: Gauss Elimination Method, Gauss-Jordan Elimination Method (TDMA). Iterative Methods: Point by Point Solution, Gauss-Seidel Method, Jacobi Method; Block Method.
5	Solution of One-Dimensional Steady and Unsteady Heat Equation Using Control Volume Method, Explicit Formulation, Crank-Nicolson Formulation, Fully Implicit Formulation.
6	Solution of Two- and Three-Dimensional Heat Conduction Equations.
7	Solution of Algebraic Equations for two- and Three-Dimensional Flows, Overrelaxation and Underrelaxation.
8	Steady One-Dimensional Convection and Diffusion, Preliminary Derivation, Exact Solution.
9	Upwind, Exponential, Hybrid, and Power-Law Formulations.
10	General Formulation and Comparison of Different Methods.
11	Two- and Three-Dimensional Convection Diffusion Equations.
12	Primitive Variables Method: SIMPLE and SIMPLER algorithms.
13	Vorticity Based Methods
14	Vorticity-Stream Function formulation

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	6	15	Case Study			Attendance		
Quiz	4	10	Lab Work			Field Study		
Midterm Exam	1	25	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	42.00
Attending Labs/Recitations (*weekly basis*)			0
Preparation beforehand and finalizing of notes (*weekly basis*)	14	2	28
Collection and selection of relevant material (*once*)	14	1	14
Self-study of relevant material (*weekly basis*)	14	2	28
Homework assignments	6	5	30
Preparation for Quizzes	4	3	12
Preparation for Midterm Exams (*including the duration of the exams*)	1	5	5

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Preparation of Term Paper/Case Study Report (*including oral presentation*)			
Preparation of Term Project/Field Study Report (*including oral presentation*)	1	15	15
Preparation for Final Exam (*including the duration of the exam*)	1	15	15
TOTAL WORKLOAD **/** 25			189/25
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.

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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	Knowledge about the basic science, mathematics and engineering sciences at high level.			X		
2	In depth knowledge, in his/her area of research including the latest development in the related area.				X	
3	Ability to reach the recent information in his/her research area and has the highest level of proficiency in the methods and skills necessary to do the research.				X	
4	Ability to perform comprehensive studies to develop a new scientific method that bring about novelty to science or technology or a technological product/process, or to apply a known method to a new field.		X			
5	Ability to perceive, design, practice and bring to completion an original research process independently; manage this process.					
6	Ability to work in teams and independently, and to lead a team; cooperate and collaborate with experts in the field.		X			
7	Contribution to scientific and technological literature by publishing the output of his/her academic studies in respected academic media.					
8	Ability to carry out cutting edge research and gather data, and transmit the results of researches to the community, with scientific objectivity and ethical responsibility.			X		
9	Ability to perform critical analysis, synthesis and evaluation of the ideas and developments in his/her profession.		X			
10	Ability to communicate with scientific and social communities in written and verbal form effectively; ability to establish written, verbal and visual communication and discussion in a foreign language at least at level C1 of the European Language Portfolio.					

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 give the students ability of solving the flow problems using numerical methods, analyze and interpret the simulation results.

Part IV Approval

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

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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	

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