

MM 475 Computational Fluid Dynamics				DEPARTMENT OF MECHANICAL ENGINEERING					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project /Field Study	Homework	Other	Total	Credit	ECTS Credit
7	42	-	20	20	8	10	100	3	3.0
Language	Turkish								
Compulsory / Elective	Elective								
Prerequisites	None								
Course Contents	Application of the finite volume method to fluid mechanics and heat transfer equations. Explanation of diffusion, convection, transient and source terms of the equations. Numerical approximations. Algebraic equations, computational cell structure. Finite volume method, discretisation process, general rules, examples. Introduction to computational fluid dynamics-CFD- principles, the PHOENICS CFD code. Operation of PHOENICS, the finite volume method, grid geometry, algebraic equations, solution procedure, boundary conditions, source terms. Application of PHOENICS to some engineering problems.								
Course Objectives	To introduce students computational fluid dynamics (CFD) principles. To teach the application of CFD to fluid mechanics and heat transfer problems. To form the theoretical basis relevant to the subject. To teach the application of CFD to various engineering problems using a commercial program.								
Learning Outcomes and Competences	Understanding of the importance of the computational fluid dynamics (CFD) method in engineering problem solving, research and development, and new product design. Formation of basic CFD principles. Evaluation of CFD application areas. Knowing the position of commercial CFD programs. Understanding of limitations in CFD applications.								
Textbook and /or Reference	1. Versteeg, H. K. and Malalasekera, W., “An Introduction to Computational Fluid Dynamics”, Longman, 1995. 2. Patankar, S. V., “Numerical Heat Transfer and Fluid Flow”, McGraw-Hill, 1980.								
Assessment Criteria						If any, mark as (x)		Percentage (%)	
	Midterm Exams					X		20	
	Quizzes					X		10	
	Homeworks					X		10	
	Projects					X		10	
	Term Paper								
	Laboratory Work					X		10	
	Other								
Final Exam					X		40		
Instructors	Prof. Senol BASKAYA								
Week	Subject								
1	INTRODUCTION: Importance of computational fluid dynamics (CFD), General view on problem definition and problem solving in fluid dynamics and heat transfer, Equations used in problem definitions.								
2	COMMERCIAL CFD CODES: How do CFD codes work, Finite volume method, Grid geometry.								
3	EXAMPLE 1: 1-dimensional heat conduction, Solution file and solution procedure.								
4	DISCRETIZATION PROCEDURE WITH THE FINITE VOLUME METHOD: 1-dimensional heat conduction, Boundary conditions and source term expressions.								
5	Boundary source linearization, General rules for the discretization of equations.								
6	NUMERICAL EXACT SOLUTION OF THE 1-DIMENSIONAL HEAT CONDUCTION PROBLEM: Formulation of governing equations, Formulation of the algebraic equations using the finite volume method.								
7	MIDTERM EXAM								
8	Interior cells, boundary cells, Numeric solution using algebraic equations.								
9	EXAMPLE 2: Laminar flow in a sudden expansion channel, Solution file and solution procedure.								
10	OTHER CFD METHOD SUBJECTS: Variable cell distributions, Blocking inside the computational domain.								
11	Relaxation, Convergence and restart, Control of accuracy and validity of CFD solutions.								
12	EXAMPLE 3: Transient natural convection, Solution file and solution procedure.								
13	LABORATORY EXAM								
14	Additional laboratory applications.								