

MM 595 Applied Computational Fluid Dynamics				MECHANICAL ENGINEERING DEPARTMENT					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1-2	18	24	60	50		36	188	3	7.5
Language	Turkish								
Compulsory / Elective	Optional								
Prerequisites	None								
Course Contents	General conservation laws and boundary conditions. Application of the finite volume method to the equations of fluid mechanics and heat transfer. Diffusion, convection, transient and source terms of the equations. Numerical approaches, algebraic equations, computational cell structure. Application of boundary conditions. Introduction to turbulent flow, transition from laminar to turbulent flow, turbulent Navier-Stokes equations, characteristics of turbulent flow, turbulence models and their equations, k-ε turbulence model, boundary conditions. Principles of Computational Fluid Dynamics (CFD), the PHOENICS CFD code, how does PHOENICS work, programs forming PHOENICS, boundary conditions, source terms. Solution of various engineering problems using PHOENICS: two and three dimensional heat conduction, forced convection inside a channel, variable cross section and blocked channel flow, natural and mixed convection problems, transient flow and heat transfer, impinging fluid jets, problems on cooling of electronic components, and similar two/three dimensional, laminar/turbulent, steady/transient, flow and heat transfer problems in cartesian/polar coordinates.								
Course Objectives	To teach theoretical knowledge and practical application ability for realization of solutions for various heat transfer and fluid flow problems encountered in engineering with a computational fluid dynamics code.								
Learning Outcomes and Competences	For a large number of heat transfer and fluid flow situations, a successful student in accord with the objective will be able to: theoretically define, choose the solution methods, solve with the PHOENICS code and interpret the solution of the problem.								
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. 3.Shaw, C. T., "Using Computational Fluid Dynamics", Prentice Hall, 1992. 4.Roache, P. J., "Fundamentals of Computational Fluid Dynamics", Hermosa, 1998. 5.Wendt, J. F., "Computational Fluid Dynamics, An Introduction", Springer, 1996. 6.Hoffmann, K. A., "Computational Fluid Dynamics For Engineers", EES, 1989.								
Assessment Criteria					If any, mark as (X)		Percentage (%)		
	Midterm Exams				X		20		
	Quizzes				-		-		
	Homeworks				X		10		
	Projects				X		10		
	Term Paper				X		10		
	Laboratory Work				X		10		
	Other				-		-		
	Final Exam				X		40		
Instructors	Prof. Senol BASKAYA								
Week	Subject								
1	General conservation laws and boundary conditions.								
2	Application of the finite volume method to the equations of fluid mechanics and heat transfer.								
3	Numerical approaches, algebraic equations, computational cell structure, application of boundary conditions.								
4	Introduction to turbulent flow, turbulent Navier-Stokes equations, characteristics of turbulent flow.								
5	Turbulence models and their equations, k-ε turbulence model, boundary conditions.								
6	Principles of Computational Fluid Dynamics (CFD), the PHOENICS CFD code.								
7	Programs forming PHOENICS, boundary conditions, source terms.								
8	Solution of various engineering problems using PHOENICS.								
9	Two and three dimensional heat conduction, forced convection inside a channel.								
10	Variable cross section and blocked channel flow.								
11	Natural and mixed convection problems.								
12	Transient flow and heat transfer.								
13	Impinging fluid jets.								
14	Problems on cooling of electronic components. Other engineering problems.								