

MM 519 Numerical Methods in Fluid Mechanics				MECHANICAL ENGINEERING DEPARTMENT					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	24	18				146	188	3	7.5
Language	Turkish								
Compulsory / Elective	Optional								
Prerequisites	-								
Course Contents	Classification of fluid flow phenomena. Fundamental flow equations. Advantages and disadvantages of numerical methods. Basic steps of numerical methods. Discretization methods. Numerical properties of discretization schemes. 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. Application of finite difference method to boundary layer type flows. Finite element method and its application to flow problems.								
Course Objectives	To teach the numerical methods used for the solution of flow problems and develop computer programs employing these method.								
Learning Outcomes and Competences	After completion of the course, students are expected to be able to apply basic numerical methods to the flow problems with appropriate boundary and initial conditions; develop algorithms and programs in a computer language and interpret the numerical results.								
Textbook and /or Reference	1. S. V. Patankar, 1980, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation. 2. H. K. Versteeg and W. Malalasekera, 1995, An Introduction to Computational Fluid Dynamics, Prentice Hall. 3. D. A. Anderson, J. C. Tannehill, Richard H. Pletcher, 1984,Computational Fluid Mechanics and Heat Transfer.								
Assessment Criteria					If any, mark as (X)		Percentage (%)		
	Midterm Exams				X		25		
	Quizzes								
	Homeworks				X		15		
	Projects								
	Term Paper								
	Laboratory Work								
	Other								
Final Exam				X		60			
Instructors	Prof. Hasmet TURKOGLU								
Week	Subject								
1	Introduction:Definitions,methods of analysis,fundamental laws.								
2	Introduction:Governing Equations,conservation of mass,momentum and energy equations								
3	Discretization Methods:Finite Difference,Finite volume,Finite element and spectral methods								
4	Solution of Linear Algebraic Equations:Direct methods,Gauss elimination method,Gauss Jordan elimination method,iterative methods.								
5	Heat Conduction:One-Dimensional unsteady heat conduction equation,explicit,implicit an Crank Nicholson formulations								
6	Heat Conduction:Two and Three dimensional heat Conduction equations								
7	Heat Conduction:Solution of algebraic equations,overrelaxation and Underrelaxation								
8	Midterm Exam I								
9	Convection diffusion Equation:Steady,one dimensional convection diffusion equation,exact								
10	Convection diffusion Equation:General Formulation,comparison of Different methods								
11	Convection diffusion Equation:Two-and three dimensionafl flows.								
12	Solution of two-aand thre e dimensionafl Navier-stokes equations:Primitive Variable method,Simple and Simler algorithms.								
13	Midterm Exam II								
14	Solution of Two-Dimensional Navier-Stokes Equation:Stream Function-Vorticity method.								