

MM 597 Advanced Numerical Methods for Engineers				MECHANICAL ENGINEERING DEPARTMENT					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS credit
1,2	18	24				146	188	3	7.5
Language	Turkish								
Compulsory / Elective	Optional								
Prerequisites	-								
Course Contents	Solution of non linear equations, Newton Raphson method, improved Newton-Raphson method, secant method. Numerical solution of non linear boundary value problems of ordinary differential equations. Numerical solution of linear and nonlinear partial differential equations; parabolic equations, hyperbolic equations, elliptic equations. Iteration methods. Nonlinear boundary conditions. Two and three dimensional elliptic and parabolic partial differential equations.								
Course Objectives	To teach the numerical methods used in the solution of ordinary and partial differential equations which are encountered in engineering problems and to improve the computer skills of the students.								
Learning Outcomes and Competences	After completion of the course, students are expected to be able to apply basic numerical methods to the solution of ordinary and partial differential equations with appropriate boundary and initial conditions; develop algorithms and programs in a computer language and interpret the numerical results.								
Textbook and /or Reference	1. Rao, S. S. (2002). Applied Numerical Methods for Engineers and Scientists. Prentice Hall. 2. Smith, G.D. Numerical Solution of Partial Differential Equations. Clarendon Press – Oxford. 3. Chapra, S. C. And Canale R. P. (1998). Numerical Methods for Engineers. Third Edition. McGraw-Hill Inc.								
Assessment Criteria					If any, mark as (X)		Percentage (%)		
	Midterm Exams				X		40		
	Quizzes								
	Homeworks								
	Projects								
	Term Paper								
	Laboratory Work								
	Other								
	Final Exam				X		60		
Instructors	Prof. Nuri YUCEL								
Week	Subject								
1	Fundamentals of Numerical Methods: Solution of non-linear equations; solution methods for systems of linear algebraic equations.								
2	Fundamentals of Numerical Methods: Numeric integration (rectangular; trapezoidal; Simpson's; Gauss-quadratures) methods								
3	Fundamentals of Numerical Methods: Interpolation, curve fitting, numeric differentiation.								
4	Ordinary Differential Equations: First order initial value problems (Euler's method, three-term Taylor series method; Runge-Kutta method).								
5	Ordinary Differential Equations: Second and higher order initial value problems (Taylor series method; Runge-Kutta method; Runge-Kutta-Nystrom method).								
6	Ordinary Differential Equations: Boundary value problems; mixed boundary conditions; shooting method.								
7	Midterm exam I								
8	Numerical Solutions of Parabolic Equations: Explicit method; implicit methods.								
9	Numerical Solutions of Parabolic Equations: Mixed boundary conditions; convergence and stability.								
10	Numerical Solutions of Hyperbolic Equations: Explicit method; Courant-Lewy-Friedrichs condition.								
11	Numerical Solutions of Hyperbolic Equations: Method of characteristics								
12	Midterm exam II								
13	Numerical Solutions of Elliptic Equations: Control volume formulation; boundary conditions.								
14	Numerical Solutions of Parabolic Equations: Formulation for curved boundaries; Gauss-Seidel iteration method.								