

MM 313E Introduction to Numerical Analysis				DEPARTMENT of MECHANICAL ENGINEERING					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project / Field Study	Homework	Other	Total	Credit	ECTS Credit
5	42	0	-		48	10	100	3	4.0
Language	English								
Compulsory / Elective	Compulsory								
Prerequisites	ENF 102								
Course Contents	Introduction: Methods used for problem solving, mathematical modeling and engineering problem solving. Major sources of errors. Finding roots of equations. Solution of systems of linear algebraic equations. Curve fitting: Least square regression, interpolation, extrapolation. Numerical differentiation and integration. Numerical solution of ordinary and partial differential equations.								
Course Objectives	To introduce the fundamentals of numerical methods used for the solution of 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 engineering problems, develop algorithms and programs in a computer language and interpret the numerical results.								
Textbook and /or Reference	1. Numerical Methods for Engineers, S. C. Chapra and R. P. Canale, McGraw-Hill, Fifth Edition. 2. Numerical Methods for Engineers, B. M. Ayyub and R. H. McCuen, Prentice Hall, First Edition 3. Applied Numerical Methods with Software, S. Nakamura, Prentice Hall, First Edition.								
Assessment Criteria						If any, mark as (x)		Percentage (%)	
	Midterm Exams					X		50	
	Quizzes					X		3	
	Homeworks					X		7	
	Projects					-			
	Term Paper					-			
	Laboratory Work					-			
	Other					-			
	Final Exam					X		40	
Instructors	Prof. Nuri YUCEL, Assoc.Prof. Ezgi GUNAY								
Week	Subject								
1	INTRODUCTION: Numerical methods used for problem solving. Steps in solving a problem with a computer. Mathematical modelling and engineering problem solving. Major sources of errors in numerical methods.								
2	ROOTS OF EQUATIONS: Graphical methods. Bracketing methods: Bisection and false-position methods.								
3	ROOTS OF EQUATIONS: Open methods: Simple one-point iteration, Newton–Raphson, secant and modified Newton–Raphson methods.								
4	SYSTEMS OF LINEAR ALGEBRAIC EQUATIONS: Introduction. Methods for solving systems of linear algebraic equations. Gauss elimination method.								
5	SYSTEMS OF LINEAR ALGEBRAIC EQUATIONS: Matrix inversion method. Gauss-Seidel method. LU decomposition methods								
6	CURVE FITTING: Introduction. Least square regression: Linear regression, polynomial regression and multiple linear regression.								
7	CURVE FITTING: Interpolation methods: Newton Interpolation, Lagrange interpolation, quadratic spline interpolation.								
8	MIDTERM EXAM I. CURVE FITTING: Cubic spline interpolation. Extrapolation.								
9	NUMERICAL INTEGRATION: Introduction. Numerical integration methods: Newton–Cotes formulas, trapezoidal rule.								
10	NUMERICAL INTEGRATION: Simpson's rules: Simpson's 1/3 rule, Simpson's 3/8 rule.								
11	NUMERICAL DIFFERENTIATION: Introduction. Finite difference approximations of the first and the second derivatives: Forward, backward and central difference approximations.								
12	MIDTERM EXAM II. NUMERICAL DIFFERENTIATION: Derivatives of unequally spaced data.								
13	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Euler's method, Runge–Kutta methods.								
14	NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS:								