IM 343 NUMERICAL ANALYSIS		CIVIL ENGINEERING	
Semester	**Credit Structure**		
	Lecture	**Recitation**	**Laboratory**
5	3	0	0
Language	English		
Compulsory / Elective	Compulsory		
Prerequisites	-		
Catalog Description	Error analysis, Determination of roots of equations, Gauss Elimination, Matrix inversion, Gauss Seidel iteration method, LU decomposition methods, Least squares regression, Numerical differentiation and integration, Numerical solutions of ordinary differential equations, Eigenvalue problems, Finite differences for elliptic and parabolic partial differential equations.		
Course Objectives	-To provide skills for performing numerical solutions of differential equations faced in engineering problems -To increase the usage of computer programming		
Course Outcomes	-Numerical solution of differential equations -Numerical solution methods for the problems that can not be solved easily by analytical methods		
Textbook and /or References	Numerical Methods for Engineers, S.C. Chapra and R.P. Canale, McGraw Hill International Editions, 1994. Computational Fluid Dynamics, K.A. Hoffmann and S.T. Chiang, Volume I, A publication of Engineering Education System, 1998.		
Assessment Criteria		**Quantity**	**Percentage**
	Midterm Exams	2	40
	Quizzes	-	-
	Homeworks	8	10
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	1	50
Course Category by Content (%)	**Mathematics and Basic Sciences**	50	
	Engineering Science	50	
	Engineering Design		
	Social Sciences		
Instructors	**Prof. Dr. Lale Balas, Yrd. Doç. Dr. Önder Koçyiğit**		

COURSE PLAN	
Week	**Topics**
1	Numerical Methods in General, Errors in computation, Numerical Stability, Programming Errors
2	Solution of Equation by Integration, Fixed- point Iteration
3	Newton's and Secant Methods, Lagrangian and Spline Interpolation
4	Numerical Integration, Trapezoidal and Simpson's Rules, Asymptotic Expansions
5	Numerical Differentiation
6	Numerical Methods in Linear Algebra, Systems of Linear Equations – Gauss Elimination
7	LU Factorization- Matrix Inversion
8	Gauss-Jordan Elimination, Gauss- Seidel and Jacobi Iterations
9	Ill- Conditioning and Norms, Tridiagonalization and QR- Factorization
10	Matrix Eigenvalue Problems
11	Numerical Methods for Differential Equation, Methods for First Order Differential Equations, Euler Method, Modified Euler Method, Heun's Method, Second order Taylor Method, Runge- Kutta Methods
12	Multistep Methods, Methods for Second- Order Differential Equations
13	Numerical Methods for Partial Differential Equations, Difference Equations for Laplace and Poisson Equations, Dirichlet Problem- Liebmann's and ADI Methods, Neumann and Mixed Problems- Irregular Boundary
14	Methods for Parabolic Equations Crank- Nicolson Method, Methods for Hyperbolic Equations

RELATIONSHIP BETWEEN THE COURSE AND DEPARTMENT CURRICULUM				
	Program Outcomes	**1**	**2**	**3**
1	An ability to apply knowledge of mathematics, science, and engineering			X
2	An ability to design and conduct experiments, as well as to analyze and interpret data	X		
3	An ability to design a system, component, or process to meet desired needs		X	
4	An ability to function on multi-disciplinary teams		X	
5	An ability to identify, formulate, and solve engineering problems			X
6	An understanding of professional and ethical responsibility		X	
7	An ability for effective written and oral communication in Turkish and English			X
8	The broad education necessary to understand the impact of engineering solutions in a global and societal context		X	
9	A recognition of the need for, and ability to engage in life-long learning			X
10	A knowledge of contemporary issues	X		
11	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice			X
	Contribution of the course : 1:None 2:Partially 3:Completely			