



# ESOGÜ Electrical-Electronics Engineering Department

**COURSE CODE:** 151225350 - 151245350

**COURSE TITLE:** Numerical Methods

Semester	Weekly Hours		COURSE					
	Theoretical	Practical	Credits	ECTS	Type	Language		
5	3	0	3	5	Compulsory ( x) Elective ( )	Turkish ( ) English (x)		
Write the credit (for non-credit courses weekly hours) below (If necessary distribute the credits.).								
<b>Math and Basic Science</b>			<b>Electrical Engineering</b> [mark (√) if there is high design content]		<b>General Education</b>	<b>Humanities</b>		
			( )					
<b>Assessment</b>			<b>THEORETICAL-PRACTICAL COURSES</b>			<b>LABORATORY COURSES</b>		
<b>Midterm</b>			<b>Type</b>	<b>Number</b>	<b>%</b>	<b>Activity Type</b>	<b>Number</b>	<b>%</b>
			Midterm	1	30	Quiz		
			Quiz	4	30	Lab performance		
			Homework			Report		
			Project			Oral exam		
<b>Final</b>				1	40			
<b>Other (.....)</b>						Other (.....)		
<b>Final</b>				1	40			
<b>Makeup exam (Oral/Written)</b>			Written					
<b>Prerequisites</b>			None					
<b>Brief content of the course</b>			Programming and algorithms. Error analysis. Root finding. Numerical solution of Linear systems. Optimization. Curve fitting, regression and interpolation. Numerical derivative and integral. Numerical solution of ordinary differential equations.					
<b>Objectives of the course</b>			In this course, numerical solution of engineering problems is explained. The methods are programmed using MATLAB.					
<b>Contribution of the course towards professional education</b>			Numerical solution and programming of engineering problems are emphasized.					
<b>Outcomes of the course</b>			Students who successfully complete this course will be able to solve and program engineering problems numerically.					
<b>Textbook of the course</b>			Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers", McGraw-Hill, 7th ed., 2015.					
<b>Other reference books</b>			Steven C. Chapra, "Applied Numerical Methods with MATLAB", McGraw-Hill, 3 <sup>rd</sup> ed., 2012. Amos Gilat, Vish Subramaniam, "Numerical Methods for engineers and Scientists", Wiley, 3rd Ed., 2014. G.R. Lindfield, J.E.T. Penny, "Numerical Methods using MATLAB", Elsevier, 3rd Ed., 2012. C. Woodford , C. Phillips, "Numerical Methods with Worked Examples: Matlab Edition", Springer, 2nd ed., 2012.					
<b>Required material for the course</b>			Computer and MATLAB software package					

## WEEKLY PLAN OF THE COURSE

Week	Topics
1	Programming, flow charts and algorithms, Error analysis.
2	Truncation errors, Taylor Series, Introduction to MATLAB.
3	Finding roots of single-variable functions numerically. Bisection, False position, Fixed point iteration and Newton Raphson and Secant methods, roots of polynomials.
4	Numerical solution of linear system equations. Gauss Elimination, LU decomposition, Gauss-Seidel and Jacobi methods
5	Finding maximum and minimum values of single-variable functions. Golden section search, parabolic interpolation, Newton's method, Brent's method. Multi-dimensional optimization: Gradients and Hessians.
6	Curve Fitting: Least Squares Regression. Linear regression, polynomial regression, nonlinear regression.
7	Curve Fitting: Interpolation. Divided difference interpolating polynomials, Lagrange interpolating polynomials, Spline interpolation. Curve fitting by using Fourier Series.
8	Midterm Examination – week1
9	Midterm Examination – week2
10	Numerical integration: Trapezoidal rule, Simpson's Rules (1/3 and 3/8). Integration of equations: Newton Cote's algorithms, Romberg integration, Adaptive quadrature, Gauss quadrature, improper integrals.
11	Numerical differentiation: High accuracy divided difference formulas, Richardson extrapolation, numerical differentiation and integration with MATLAB.
12	Numerical solution of ordinary differential equations: Euler Methods, Runge-Kutta Methods, Stiffness, multistep methods.
13	Boundary value problems
14	Eigenvalue problems
15,16	Final

NO	OUTCOMES OF THE PROGRAMME	4	3	2	1
1	Adequate knowledge of mathematics, science and Electrical and Electronic Engineering; ability to practice theoretical and practical knowledge of these areas into modeling and solving complex problems of Electrical and Electronic Engineering	X			
2	Ability to identify complex engineering problems in Electrical and Electronic Engineering and related fields, for this purpose having skills to formulate, select and apply appropriate methods.		X		
3	Having skills to apply modern design methods to design a complex system, process, equipment or product that should work under realistic conditions and constraints and satisfy specific requirements concerning the Electrical and Electronic Engineering.				
4	Having skills to develop, select and apply modern techniques and tools needed to analyze and solve complex applications in Electrical and Electronic Engineering, skills to use information technology effectively.	X			
5	Skills to design and conduct tests, collect data, analyze results, and interpret data for the experimental investigation of complex problems in Electrical and Electronic Engineering		X		
6	Ability to function effectively as an individual and as a member of teams within the discipline and in multidiscipline areas.				
7	Communicating effectively in oral and written form both in Turkish and English. Effective report writing and understanding written reports, preparing design and manufacturing reports, making effective presentations, skills to give and receive clear and concise instructions.				
8	Awareness of the necessity of lifelong learning, access to information, monitoring developments in science and technology and the ability to self-renewing				
9	Understanding of professional and ethical responsibility				
10	Information on project management, change management and risk management practices, awareness on entrepreneurship and innovation, knowledge on sustainable development.				
11	Information about universal and societal effects of engineering applications on health, safety and environment; awareness of the legal consequences of engineering solutions.				

**Scale for assessing the contribution of the course to the program outcomes:**

**4: High                  3: Medium                  2: Low                  1:None**

**Name of Instructor(s):** Yrd.Doç.Dr. H. Serhan Yavuz

**Signature(s):**

**Date:** March 11, 2016