Department of Geomatics Engineering / Department of Geomatics Engineering / Department of Geomatics Engineering

Course Code	Course Name	Teorical	Practice	Laboratory	Credits	ECTS
MAT301	NUMERICAL METHODS IN ENGINEERING	3.00	0.00	0.00	3.00	4.00

Course Detail

Course Language	:	English
Qualification Degree	:	Bachelor
Course Type	:	Compulsory
Preconditions	:	Not
Objectives of the Course	:	Teaching numerical solution of the problems arising in Science and Engineering and the mathematical prgramming for these techniques are aimed in this course..
Course Contents	:	Taylor Series. Error in numerical Analysis. Techniques of solving non-linear equation: Bisection method, Secant method, Newton's method, Fixed point iteration . Solving Systems: Jacobi method, Gauss-Siedel Method. Interpolation: Lagrange Interpolation, Splines. Least Square Approximation. Numerical Differentiation. Numerical Integration: Trapezoidal Rule, Simpson's rule. Numerical Solution of ODEs: Explicit Euler, Implicit Euler, Midpoint Rule, Runge -Kutta method. Numerical Solutions of BVPs. Numerical Solution of PDEs: Finite difference Methods.
Recommended or Required Reading	:	1) Numerical Methods Using MATLAB: International Edition, 4/E (John H. Mathews, Kurtis K. Fink) 2) An Engineer's Guide to MATLAB (E.B. Magrab, S.Azarm, B. Balachandran, J. H. Duncan, K. E. Herold, G.C. Walsh)
Planned Learning Activities and Teaching Methods	:	Student-centered, homework and computer-aided, face to face education.
Recommended Optional Programme Components	:	To know the basics of programming.
Instructors	:	Assoc. Prof. Dr. Sıla Övgü Korkut Uysal
Instructor's Assistants	:	none
Presentation Of Course	:	Face to face and computer aided presentation
En Son Güncelleme Tarihi:	:	2/12/2024 1:29:52 PM

Course Outcomes

Upon the completion of this course a student :

1 will be able to discuss the usage of the numerical methods, define the error, will be able to explain the root-finding techniques, and create MATLAB programs. Build simple loops using MATLAB

2 will be able to list the numerical methods of solving systems and to distinguish the differences

3 will be able to construct a polynomial with some experimental data and will be able to create the nonlinear function by considering minimum error.

4 will be able to compute integral and differentiation by using any numerical analysis techniques.

5 will be able to identify and categorize the numerical analysis techniques for ordinary differential equations and create MATLAB programs of these methods.

Preconditions

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Weekly Contents

	Teorical	Practice	Laboratory	Preparation Info	Teaching Methods	Course Learning Outcomes
1.Week	*Introduction to Numerical Methods Preliminaries A general look at the concept of "Error"				*Face to face and computer aided education	
2.Week	*Introduction to MATLAB program Important Loops The concepts of Input & Output				*Computer aided and interactive education	
3.Week	*The methods of root finding: 1) Bisection method 2) Secant Method 3) Newton-Raphson method				*Face to face- interactive education	
4.Week	*Algorithms of the root finding methods in MATLAB; tools of MATLAB for froot finding				*Computer aided interactive education	
5.Week	*Numerical methods for systems: 1) Gauss-Seidel 2) Newton's method for systems				*Computer aided and interactive education	
6.Week	*Discussion of approximate solutions of systems by using MATLAB					
7.Week	*Introduction to Interpolation Creating a polynomial using data 1) Lagrange Interpolation method 2) Newton-divided difference method				*Face to face and iinteractive education	
8.Week	*Midterm Exam					
9.Week	*Continuation to Interpolation 3) The least square approximation(Regression) 3.1) Linear equation 3.2) non-linear equation				*Face to face and interactive education	
10.Week	*Interpolation via MATLAB: codding- using MATLAB tools				*Computer aided, interactive and face to face education	
11.Week	*Numerical Differentiation 1) Forward difference method 2) Backward Difference method 3) Central difference method 4) construction of a method					
12.Week	*Numerical Integration 1) Trapezoidal rule 2) Midpoint rule 3)Gauss- Quadrature method				*Face to face and interactive education	
13.Week	*Numerical Solutions of Ordinary Differential Equations 1) Explicit Euler method 2) Implicit Euler method 3) Heun Method 4) 4th order Runge-Kutta method				*face to face and interactive education	
14.Week	*Numerical solutions of Ordinary Differential Equations- Boundary Value Problems				*face to face and interactive education	

Assesment Methods %

1 Final : 50.000

2 Midterms : 50.000

ECTS Workload

Activities	Count	Time(Hour)	Sum of Workload
Vize / Midterms	1	2.00	2.00
Final / Final	1	2.00	2.00
Derse Katılım / Attending lectures	14	3.00	42.00
Ders Öncesi Biresysel Çalışma / Individual study before lecture	14	1.00	14.00
Ders Sonrası Biresysel Çalışma / Individual study after lecture	14	3.00	42.00
Ara Sınav Hazırlık / Preparation for midterm	1	10.00	10.00
Final Sınavı Hazırlık / Preparation for final	1	10.00	10.00
Bütünleme / Make-up	1	2.00	2.00
		Total :	124.00
		Sum of Workload / 30 (Hour) :	4
		ECTS :	4.00

Program And OutcomeRelation

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11
L.O. 1	0	0	0	0	0	0	0	0	0	0	0
L.O. 2	0	0	0	0	0	0	0	0	0	0	0
L.O. 3	0	0	0	0	0	0	0	0	0	0	0
L.O. 4	0	0	0	0	0	0	0	0	0	0	0
L.O. 5	0	0	0	0	0	0	0	0	0	0	0