ESOGU CIVIL ENGINEERING DEPARTMENT

COURSE INFORMATION FORM

Course Name	Course Code
NUMERICAL METHODS	151414560

Semester	Number of Course Hours per Week		ECTS
	Theory	**Practice**	
4	4	0	4

Course Category (Credit)				
Basic Sciences	**Engineering Sciences**	**Design**	**General Education**	**Social**
2	2			

Course Language	Course Level	Course Type
Turkish	Undergraduate	Compulsory

Prerequisite(s) if any	-
Objectives of the Course	To teach numerical solution of the problems that cannot be solved with analytical methods, algorithms of these methods and written algorithms in a computer programming language or solved with the help of a computer program.
Short Course Content	The basic principles of numerical methods used to solve engineering problems. Matrices, determinants. Systems of linear equations and solution methods. Iterative methods. Balancing account, curve fitting. A homogeneous system of equations, the standard eigenvalue problem. Root finding, numerical integration.

	Learning Outcomes of the Course	**Contributed PO(s)**	**Teaching Methods ***	**Measuring Methods ****
1	Performs matrix operations	1, 2	1, 5, 10	A, K
2	Recalls and uses systems of linear equations and solution methods	1, 2	1, 5, 10	A, K
3	Recalls and uses nonlinear systems of equations and solution methods.	1, 2	1, 5, 10	A, K
4	Defines approximation and numerical error.	1, 2	1, 5, 10	A, K
5	Explains the sources of numerical error and summarizes the methods to reduce the total numerical error.	1, 2	1, 5, 10	A, K
6	Derive functions that fit the data.	1, 2	1, 5, 10	A, K
7	Defines the eigenvalue, eigenvector problem and determines the calculation method	1, 2	1, 5, 10	A, K
8	Uses iteration methods in solving systems of equations and finding the roots of functions.	1, 2	1, 5, 10	A, K
9	Solves numerical differentiation and numerical integration problems.	1, 2	1, 5, 10	A, K
10	Uses modern computer methods, programs and tools in solving engineering problems.	1, 2	1, 5, 10	A, K

*Teaching Methods 1:Expression, **2:**Discussion, **3:**Experiment, **4:**Simulation, **5:**Question-Answer, **6:**Tutorial, **7:**Observation, **8:**Case Study, **9:**Technical Visit, **10:**Trouble/Problem Solving, **11:**Induvidual Work, **12:**Team/Group Work, **13:**Brain Storm, **14:**Project Design / Management, **15:**Report Preparation and/or Presentation

Measuring Methods A:Exam, **B:Quiz, **C:**Oral Exam, **D:**Homework, **E:**Report, **F:**Article Examination, **G:**Presentation, **I:**Experimental Skill, **J:**Project Observation, **K:**Class Attendance; **L:**Jury Exam

Main Textbook	Topçu, A. Bilgisayar destekli nümerik analiz. Ders notları. Chapra, S.C., Canale, R.P., (Çeviri: H. Heperkan, U. Kesgin), "Yazılım ve Programlama Uygulamalarıyla Mühendisler İçin Sayısal Yöntemler", Literatür Yayıncılık, İstanbul, 2003.
Supporting References	Akai, T.J., "Applied Numerical Methods for Engineers", John Wiley&Sons, NewYork,1993 Chapra, S.C., Canale, R.P., "Numerical Methods for Engineers", McGraw Hill, 2006
Necessary Course Material	Calculator, pencil, eraser, computer, projector, classroom with curtains.

Course Schedule	
1	Introduction, reminding basic mathematical concepts, using calculator effectively
2	Matrix notation, matrix types, four operations in matrices, determinant calculation
3	Inverse matrix calculation
4	Linear systems of equations, direct methods in solving systems of equations, solving systems of equations by simple Gaussian method
5	Error sources, error estimation, vector and matrix norms
6	Solving system of equations using factorization, LU (Doolittle) and Cholesky methods
7	Solving system of equations with iteration methods, Jacobi, Gauss-Seidel
8	Mid-Term Exam
9	Balancing calculation, curve fitting
10	Homogeneous equation system analysis
11	Eigenvalue, Eigenvector, Standard eigenvalue problem
12	General eigenvalue problem, eigenvalue-period and eigenvector-mode relation
13	Finding the roots of functions
14	Numerical integral
15	Numerical derivative
16,17	Final Exam

Calculation of Course Workload			
Activities	Number	Time (Hour)	Total Workload (Hour)
Course Time (number of course hours per week)	14	3	42
Classroom Studying Time (review, reinforcing, prestudy,….)	14	3	42
Homework	0	1	0
Quiz Exam	0	1	0
Studying for Quiz Exam	0	1	0
Oral exam	0	1	0
Studying for Oral Exam	0	1	0
Report (Preparation and presentation time included)	0	1	0
Project (Preparation and presentation time included)	0	1	0
Presentation (Preparation time included)	0	1	0
Mid-Term Exam	1	2	2
Studying for Mid-Term Exam	1	12	12
Final Exam	1	2	2
Studying for Final Exam	1	13	13
Total workload			113
Total workload / 30			3,8
Course ECTS Credit			4

Evaluation	
Activity Type	**%**
Mid-term	40
Quiz	-
Homework	-
Bir öğe seçin.	
Bir öğe seçin.	
Final Exam	60
Total	100

	RELATIONSHIP BETWEEN THE COURSE LEARNING OUTCOMES AND THE PROGRAM OUTCOMES (PO) (5: Very high, 4: High, 3: Middle, 2: Low, 1: Very low)	
NO	**PROGRAM OUTCOME**	**Contribution**
1	Strong background in mathematics, science, and fundamental engineering principles; ability to apply theoretical and practical knowledge from these fields to model and solve engineering problems	4
2	Expertise in identifying, defining, and formulating complex engineering problems in civil engineering and related fields. Ability to select and apply appropriate analysis and modeling methods to solve these problems	4
3	Ability to design complex systems, devices, or products under realistic constraints and conditions. Proficiency in using modern design methods to meet specific objectives	
4	Competence in developing, selecting, and using modern techniques and tools for civil engineering applications. Effective utilization of information technologies to support engineering tasks	
5	Expertise in designing experiments, conducting tests, collecting data, analyzing results, and interpreting findings for civil engineering problem investigations	
6	Ability to work effectively in both intradisciplinary and interdisciplinary teams	
7	Effective Turkish oral and written communication skills and proficiency in using and developing foreign language skills	
8	Commitment to lifelong learning. Ability to access information, stay up-to-date with advances in science and technology, and continuously self-improve	
9	Strong sense of professional and ethical responsibility	
10	Knowledge of project management, risk management, and change management practices; awareness of entrepreneurship, innovation, and sustainable development principles	
11	Understanding of the global and societal impacts of engineering applications on health, the environment, and safety; awareness of national and international legal regulations, standards, and the legal implications of engineering solutions	
12		

LECTURER(S)				
Prepared by	Asst. Prof. Dr. Uğur ALBAYRAK			
Signature(s)				

Date: 25.06.2024