



İZMİR UNIVERSITY OF ECONOMICS

Faculty of Engineering and Computer Science
Computer Engineering

MATH 250 - Linear Algebra and Differential Equations for Engineers

COURSE INTRODUCTION AND APPLICATION INFORMATION

Course Name	Code	Semester	Theory (hour/week)	Application/Laboratory (hour/week)	Local Credits	ECTS
Linear Algebra and Differential Equations for Engineers	MATH 250	Spring	3	0	3	6

Prerequisites	None
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Course Language	English
Course Type	Required
Course Level	First Cycle
Course Coordinator	* <u>Yrd. Doç. Dr. Sevin GÜMGÜM</u>
Course Lecturer(s)	* <u>Yrd. Doç. Dr. Sevin GÜMGÜM</u> * <u>Yrd. Doç. Dr. Özge Sağlam</u> * <u>Yrd. Doç. Dr. Mehmet Türkan</u>
Course Assistants	* <u>Araş. Gör. Halis Can KOYUNCUOĞLU</u> * <u>Araş. Gör. Burçin KÜLAHÇIOĞLU</u>
Course Objectives	The main objective of this course is to establish a basic mathematical background for the students who will receive engineering courses based on linear algebra and/or linear differential equations by providing them with the basic knowledge on linear vector spaces, matrix operations and linear differential equations , as well as on the methods for solving and analyzing linear systems of algebraic and differential equations.
Course Learning Outcomes	The students who succeeded in this course; * will be able to find dimension and basis vectors of linear vector spaces and subspaces * will be able to perform matrix operations * will be able to analyze linear transformations and systems of linear equations by determining rank, eigenvalue-eigenvector set and other features of matrices

	<p>* will be able to solve first-order ordinary differential equations</p> <p>* will be able to find the solution of second order non-homogeneous differential equations</p>
Course Content	The main subjects of the course are the vector and matrix operations, linear independence and dependence of vectors, linear vector spaces and subspaces, dimensions and basis vectors for vector spaces, linear transformations, determinants, solution methods for ordinary differential equations and their engineering applications, eigenvalues-eigenvectors analysis and diagonalization

WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES

Week	Subjects	Related Preparation
1	Systems of linear equations, row reduction and echelon forms, vector equations.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 1.1, 1.2, 1.3.
2	The matrix equation $Ax=b$, solution set of linear systems, linear independence.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 1.4, 1.5, 1.7.
3	Introduction to linear transformations, the matrix of a linear transformation, matrix operations.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 1.8, 1.9, 2.1.
4	The inverse of a matrix, characterizations of invertible matrices, partitioned matrices.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 2.2, 2.3, 2.4.
5	Matrix factorizations, subspaces of R^n , dimension and rank.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 2.5, 2.8, 2.9.

6	Introduction to determinants, properties of determinants, Cramer's rule. MIDTERM EXAM 1	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 3.1, 3.2, 3.3.
7	Vector spaces and subspaces, null spaces, column spaces and linear transformations, linearly independent sets, bases.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 4.1, 4.2, 4.3.
8	Coordinate systems, the dimension of a vector space, rank.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 4.4, 4.5, 4.6.
9	Change of basis, eigenvectors and eigen values, the characteristic equation.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 4.7, 5.1, 5.2.
10	Diagonalization, eigenvectors and linear transformations, inner product, length and orthogonality.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 5.3, 5.4, 6.1.
11	Orthogonal sets, orthogonal projections, the Gram-Schmidt process, least-squares problem.	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Section 6.2, 6.3, 6.4, 6.5.
12	First order ordinary differential equations: Exact differential equations and integrating factor, separable equations and equations reducible to this form. MIDTERM EXAM 2	Introduction to Ordinary Differential Equations, Shepley L. Ross, Wiley, 4th Edition, Section 2.1, 2.2.
13	Linear equations and Bernoulli equations, homogeneous differential equations.	Introduction to Ordinary Differential Equations, Shepley L. Ross, Wiley, 4th Edition, Section 2.1, 2.2.
14	Explicit methods for solving higher order linear differential equations: Basic theory of differential equations, homogeneous linear differential equations with constant coefficients.	Introduction to Ordinary Differential Equations, Shepley L. Ross, Wiley, 4th Edition, Section 4.1, 4.2.

15	The method of undetermined coefficients variation of parameters, Cauchy-Euler equation.	Introduction to Ordinary Differential Equations, Shepley L. Ross, Wiley, 4th Edition, Section 4.3, 4.4, 4.5.
16	Final exam.	

SOURCES

Course Notes / Textbooks	Linear Algebra and Its Applications, David C. Lay, Steven R. Lay, Judi J. McDonald, Pearson, 5th Edition, Introduction to Ordinary Differential Equations, Shepley L. Ross, Wiley, 4th Edition
References	1) Elementary Linear Algebra, Howard Anton, Chris Rorres, Wiley, 9th Edition. 2) Linear Algebra, Seymour Lipschutz, Schaum's Online Series, 2nd Edition.

EVALUATION SYSTEM

Semester Requirements	Number	Percentage of Grade
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Quizzes/Studio Critics	-	-
Homework Assignments	-	-
Presentation/Jury	-	-
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	2	60
Final/Oral Exam	1	40
Total	3	100

PERCENTAGE OF SEMESTER WORK	2	60
PERCENTAGE OF FINAL WORK	1	40
Total	3	100

COURSE CATEGORY

Course Category	Core Courses	X
	Major Area Courses	
	Supportive Courses	
	Media and Management Skills Courses	
	Transferable Skill Courses	

THE RELATIONSHIP BETWEEN COURSE LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

#	Program Qualifications / Outcomes	* Level of Contribution				
		1	2	3	4	5
1	<p>Adequate knowledge in Mathematics, Science and Computer Engineering; ability to use theoretical and applied information in these areas to model and solve Computer Engineering problems</p>					X
2	Ability to identify, define, formulate, and solve complex Computer Engineering problems; ability to select and apply proper analysis and modeling methods for this purpose				X	
3	Ability to design a complex computer based system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose					
4	Ability to devise, select, and use modern techniques and tools needed for Computer Engineering practice					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating Computer Engineering problems			X		
6	Ability to work efficiently in Computer Engineering disciplinary and multi-disciplinary teams; ability to work individually					
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of two foreign languages					
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself					
9	Awareness of professional and ethical responsibility					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of Computer Engineering solutions					

*1 Lowest, 2 Low, 3 Average, 4 High, 5 Highest

ECTS / WORKLOAD TABLE

Activities	Number	Duration (Hours)	Total Workload
Course Hours (Including Exam Week: 16 x Total Hours)	16	3	48
Laboratory	-	-	-
Application	-	-	-
Special Course Internship (Work Placement)	-	-	-
Field Work	-	-	-
Study Hours Out of Class	16	3	48
Presentations / Seminar	-	-	-
Project	-	-	-
Homework Assignments	-	-	-
Quizzes	-	-	-
Midterms / Oral Exams	2	20	40
Final / Oral Exam	1	44	44
		Total Workload	180