

Identification	Subject	MATH 310, Applied Differential Equations, 6 ECTS
	Department	Mathematics
	Program	Undergraduate
	Term	Fall, 2026
	Instructor	Mammadova Saida Oqtay
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	Classroom/hours	Monday: 08:30-10:00, 10:10-11:40
Prerequisites	<i>Applied Differential Equations</i> is a second-year, first-semester course. The prerequisite is Calculus 2.	
Language	English	
Compulsory/Elective	Required	
Required textbooks and course materials	Core Textbooks: 1. William E.Boyce and Richard C. DiPrima, <i>Elementary Differential Equations and Boundary Value problems</i>, 10th edition, 2012 Supplementary book 1. Dennis G. Zill, Warren S. Wright, and Michael R. Cullen, <i>Differential Equations with Boundary-Value Problems</i>, 8th edition, 2013, 673 p. 2. Vladimir A. Dobrushkin, <i>Applied Differential Equations The Primary Course</i>, 2nd Edition, 2022, 706p. 3. Steven Krantz, <i>Differential Equations. A Modern Approach with Wavelets</i>, 1th edition, 2023, 482 p. 4. Team Educohack, <i>Differential Equations: An Intro to Applied Math</i>, 2024, 587p.	
Course outline	Applied Differential Equations is a foundational course at the School of Science and Engineering, Khazar University, and plays an important role in understanding key concepts across science, engineering, economics, computer science, and other disciplines. The course begins by reviewing basic concepts of analysis and the general properties of differential equations, then introduces first-order differential equations along with methods for classifying them as linear or nonlinear and various integration techniques used to solve them. Students then move on to second- and higher-order differential equations, including the solution of homogeneous linear equations with constant coefficients and nonhomogeneous equations solved through the method of undetermined coefficients and the method of variation of parameters. The final part of the course introduces the Laplace transform, along with a review of matrices, systems of linear algebraic equations, linear independence, eigenvalues, eigenvectors, and nonhomogeneous linear systems.	
Course objectives	The primary aim of this course is to develop students' ability to translate real-world phenomena into mathematical models using differential equations, and to solve these models through both analytical and numerical approaches. Students will learn to identify different types of differential equations and apply the right techniques to solve them. The course also explains when a differential equation has a solution and when that solution is unique. In addition, students will become familiar with essential tools such as Laplace transforms and Fourier analysis, which extend their ability to solve a broader range of problems encountered in applied mathematics and engineering.	

Learning outcomes	By the end of the course the students should be able: • To solve first order differential equations • To solve higher order homogeneous and nonhomogeneous equations with constant coefficients • To find Laplace transform and inverse Laplace transform • To solve initial value problem • To find eigenvalues and eigenvectors		
Teaching methods	Lecture		x
	Group discussion		x
	Experiential exercise		x
	Simulation		
	Case analysis		
	Course paper		x
	Others		
Evaluation	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Case studies		
	Class Participation		5
	Quizzes		20 (4 quizzes)
	Activity		5
	Project		
	Laboratory work		
	Final Exam		40
	Others		
	Total		100
Policy	▪ Use of Generative AI Tools The use of generative artificial intelligence (GAI) tools is strictly prohibited in this course. The primary aim of the course is to develop students' independent mathematical reasoning, problem-solving skills, and creative thinking. Students are therefore expected to complete all assignments and assessments independently without the use of GAI tools. If it is determined that a student has used generative artificial intelligence (GenAI) tools while completing assignments, one of the following measures may be applied: • Issuing an oral or written warning; • Requiring the resubmission of the assignment; • Reducing the grade for the assignment or assigning a zero (0). ▪ Attendance Students who do not attend more than 30% of online classes will not be allowed to take the exam. ▪ Quizzes Quizzes may be given unannounced throughout the term. There will be no make-up quizzes. ▪ Withdrawal (pass/fail) This course strictly follows grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at		

least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. ▪ Cheating/plagiarism Cheating or other plagiarism during the Quizzes, Mid-term and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations. ▪ Professional behavior guidelines The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. ▪ Ethic Use of any electronic devices is prohibited in the classroom. All devices should be turned off before entering class. This is a university policy and <u>violators will be reprimanded accordingly!</u> Students should not arrive in late to class!			
Tentative Schedule			
Week	Date/Day (tentative)	Topics	Textbook/ Assignments
1.	21.09.26 21.09.26	• Linear Equations; Method of integrating factor • Separable equations	2.1, 2.2
2.	28.09.26 28.09.26	• Exact equation, integrating factors • Practice	2.6
3.	05.10.26 05.10.26	• Second Order Linear Equations. Homogeneous equations with constant coefficients • Solutions of linear homogeneous equations; the Wronskian	3.1, 3.2
4.	12.10.26 12.10.26	• Complex roots of the characteristic equation • Practice	3.3 Quiz (5 pts)
5.	19.10.26 19.10.26	• Repeated roots; Reduction of order • Nonhomogeneous Equations; Method of Undetermined Coefficients	3.4, 3.5
6.	26.10.26 26.10.26	• Variation of parameters • Homogeneous equations with constant coefficients	3.6, 4.2
7.	02.11.26 02.11.26	• The Method of Undetermined Coefficients • Practice	4.3 Quiz (5 pts)
8.	09.11.26 09.11.26	• Holiday	
9.	16.11.26 16.11.26	• Midterm Exam • The method of variation of parameters	4.4
10.	23.11.26 23.11.26	• Definition of the Laplace Transform • Solution of Initial Value Problem	6.1, 6.2
11.	30.11.26 30.11.26	• Step Functions • Review of Matrices	6.3, 7.2
12.	07.12.26 07.12.26	• Systems of Linear Algebraic Equations; Linear independence; Eigenvalues; Eigenvectors • Practice	7.3 Quiz (5 pts)

13.	14.12.26 14.12.26	• Homogeneous Linear systems with Constant coefficients • Complex Eigenvalues	7.5, 7.6
14.	21.12.26 21.12.26	• Fundamental Matrices • Practice	7.7 Quiz (5 pts)
15.	28.12.26 28.12.26	• Repeated Eigenvalues • Nonhomogeneous Linear Systems	7.8 , 7.9
	TBA	Final Exam	

This syllabus is a guide for the course and any modifications to it will be announced in advance.