Identification	**Subject**	MATH310, Applied Differential Equations A, 6 ECTS
	Department	Mathematics
	Program	Undergraduate
	Term	Fall, 2025
	Instructor	Lala Atamova
	E-mail:	ljafarova@khazar.org
	Phone:	
	Classroom/hours	Tuesday: 13:40-15:10, Thursday: 13:40-15:10.
Prerequisites	*Applied Differential Equations* 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, Elementary Differential Equations and Boundary Value problems, 10th edition, 2012 **Supplementary book** 1. Dennis G. Zill, Warren S. Wright, and Michael R. Cullen, *Differential Equations with Boundary-Value Problems*, 8th edition, 2013, 673 p.	
Course outline	Applied differential equations play a vital role in understanding concepts across science, engineering, economics, computer science, and other disciplines. This course covers both analytical and numerical methods for solving first-order and higher-order ordinary differential equations (ODEs), with a strong emphasis on real-world applications. Students will explore the mathematical modeling of physical systems, such as electrical circuits and population dynamics. Common topics include Laplace transforms, Fourier series, and matrix methods for systems of ODEs.	
Course objectives	Applied differential equations courses aim to equip students with the ability to model real-world phenomena, solve these models both analytically and numerically, and understand the fundamental theory behind differential equations. Course objectives include learning to identify different types of differential equations, applying analytical techniques to find solutions, understanding the conditions for existence and uniqueness of solutions, and using tools such as Laplace transforms and Fourier analysis.	
Learning outcomes	By the end of the course the students should be able to: • Classify and identify different types of differential equations, • Determine if a given function is a solution to a particular differential equation; apply the theorems for existence and uniqueness of solutions to differential equations appropriately; • Distinguish between (a) linear and non-linear differential equations; (b) ordinary and partial differential equations; (c) homogeneous and non-homogeneous differential equations; • Solve ordinary differential equations and systems of differential equations using:	

<table>
<tr><td></td><td colspan="3">(a) Direct integration
(b) Separation of variables
(c) Methods of undetermined coefficients and variation of parameters and interpret their qualitative behavior,
• Determine particular solutions to differential equations with given initial conditions.
• Analyze real-world problems such as motion of a falling body, compartmental analysis, free and forced vibrations, etc.; use analytic technique to develop a mathematical model, solve the mathematical model and interpret the mathematical results back into the context of the original problem.
• Apply ideas from linear algebra in order to solve single linear ordinary differential equations and systems of such equations,
• Model certain physical phenomena using differential equations and reinterpret their solutions physically,
• Apply the Laplace transform for solving differential equations.</td></tr>
<tr><td rowspan="7">Teaching methods</td><td colspan="2">Lecture</td><td>x</td></tr>
<tr><td colspan="2">Group discussion</td><td>x</td></tr>
<tr><td colspan="2">Experiential exercise</td><td>x</td></tr>
<tr><td colspan="2">Simulation</td><td></td></tr>
<tr><td colspan="2">Case analysis</td><td></td></tr>
<tr><td colspan="2">Course paper</td><td>x</td></tr>
<tr><td colspan="2">Others</td><td></td></tr>
<tr><td rowspan="10">Evaluation</td><td>Methods</td><td>Date/deadlines</td><td>Percentage (%)</td></tr>
<tr><td>Midterm Exam</td><td></td><td>30</td></tr>
<tr><td>Case studies</td><td></td><td></td></tr>
<tr><td>Class Participation</td><td></td><td>5</td></tr>
<tr><td>Quizzes</td><td></td><td>20(4 quizzes)</td></tr>
<tr><td>Activity</td><td></td><td>5</td></tr>
<tr><td>Project</td><td></td><td></td></tr>
<tr><td>Laboratory work</td><td></td><td></td></tr>
<tr><td>Final Exam</td><td></td><td>40</td></tr>
<tr><td>Others</td><td></td><td></td></tr>
<tr><td>Total</td><td></td><td>100</td></tr>
<tr><td>Policy</td><td colspan="3">Preparation for class
The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions. Throughout the semester we will also have a large number of review sessions. These review sessions will take place during the regularly scheduled class periods.</td></tr>
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Quizzes and examinations
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 violators will be reprimanded accordingly!
Students should not arrive in late to class!

Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook/ Assignments
1	16.09.25 18.09.25	• Linear Equations; Method of integrating factor • Separable equations	**2.1, 2.2**
2	23.09.25 25.09.25	• Exact equation, integrating factors • Homogeneous equations with constant coefficients	**2.6, 3.1**
3	30.09.25 02.10.25	• Solutions of linear homogeneous equations; the Wronskian • Complex roots of the characteristic equation	**3.2, 3.3, Quiz (5 pts)**
4	07.10.25 09.10.25	• Repeated roots; Reduction of order • Nonhomogeneous Equations	**3.4, 3.5**
5	14.10.25 16.10.25	• Method of Undetermined Coefficients • Variation of parameters	**3.5, 3.6**
6	21.10.25 23.10.25	• Homogeneous equations with constant coefficients • Practice	**4.2**
7	28.10.25 30.10.25	• The Method of Undetermined Coefficients.	**4.3, 4.4 Quiz (5 pts)**

		• The method of variation of parameters	
8	04.11.25 06.11.25	• Definition of the Laplace Transform • Solution of Initial Value Problem	**6.1, 6.2**
9	11.11.25 13.11.25	• **Midterm Exam** • Step Functions	**6.3**
10	18.11.25 20.11.25	• Review of Matrices • Practice	**7.2**
11	25.11.25 27.11.25	• Systems of Linear Algebraic Equations; Linear independence; Eigenvalues; Eigenvectors • Practice	**7.3** **Quiz (5 pts)**
12	02.12.25 04.12.25	• Homogeneous Linear systems with Constant coefficients • Practice	**7.5**
13	09.12.25 11.12.25	• Complex Eigenvalues • Practice	**7.6**
14	16.12.25 18.12.25	• Fundamental Matrices • Practice	**7.7** **Quiz (5 pts)**
15	23.12.25 25.12.25	• Repeated Eigenvalues, Nonhomogeneous Linear Systems • Practice	**7.8**
	TBA	**Final Exam**	

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