| Identification | Subject | MATH 235, Applied linear algebra and analytic geometry, 6 ECTS |
|---|---|---|
| | Department | Mathematics |
| | Program | Undergraduate |
| | Term | Fall, 2025 |
| | Instructor | Rza Mustafayev |
| | E-mail: | rzamustafayev@gmail.com |
| | Phone: | |
| | Classroom/hours | Thursday: 18:40-20:10, 20:20-21:00 |
| **Prerequisites** | *Applied linear algebra and analytic geometry* is a second-year, first-semester course. The prerequisite is Calculus 2 course. | |
| **Language** | English | |
| **Compulsory/Elective** | Required | |
| **Required textbooks and course materials** | **Core Textbooks:** V.V. Konev. Linear Algebra, Vector Algebra and Analytical Geometry,Textbook. Tomsk: TPU Press, 2009, 114 pp. | |
| **Course outline** | Applied linear algebra and analytic geometry is a major course at School of Science and Engineering of Khazar University; it plays a role in the understanding of science, engineering, economics, and computer science, among other disciplines. This introductory course covers three content areas: Linear Algebra, Vector Algebra and Analytical Geometry. Each part contains basic mathematical conceptions and explains new mathematical terms. Many useful examples and exercises are presented in the textbook. explained and illustrated by examples and exercises. | |
| **Course objectives** | 1. **Understand and apply vector operations**<br>• Perform operations with vectors in two and three dimensions, including addition, scalar multiplication, dot product, and cross product.<br>• Interpret geometric meaning of vector operations.<br>2. **Solve systems of linear equations using multiple methods**<br>• Apply Gaussian and Gauss-Jordan elimination techniques.<br>• Use matrix methods, including row reduction and inverse matrices, to solve linear systems.<br>3. **Understand the theory and application of matrices**<br>• Perform basic matrix operations (addition, multiplication, transpose, inverse).<br>• Apply concepts of matrix rank, determinants, and elementary matrices.<br>• Understand special types of matrices (symmetric, orthogonal, diagonal, etc.).<br>4. **Apply geometric interpretations in analytic geometry**<br>• Analyze lines, planes, and surfaces in two and three dimensions.<br>• Use vector and parametric equations to represent geometric objects.<br>• Understand conic sections and quadric surfaces using algebraic and geometric techniques. | |
| **Learning outcomes** | By the end of the course the students should be able:<br>1. To do matrix operations<br>2. To compute determinants<br>3. To solve systems of linear equations<br>4. To solve problems about geometrical applications of vector operations | |
| **Teaching methods** | **Lecture** | x |
| | **Group discussion** | x |

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|---|---|---|---|
| | 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 (2 quizzes) |
| | **Activity** | | 5 |
| | **Project** | | |
| | **Laboratory work** | | |
| | **Final Exam** | | 40 |
| | **Others** | | |
| | **Total** | | 100 |

**Policy**

- **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.

- **Attendance**
  Students who do not attend more than 25 % of online classes will not be allowed to take the exam.

- **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 <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 | 18.09.2025<br><br>18.09.2025 | Matrices: Basic definitions, Matrix operations, Types of matrices, Kronecker Delta Symbol, Properties of Matrix Operations | p. 7 - 19 |
| 2 | 25.09.2025<br><br>25.09.2025 | Determinants: Permutations and Transpositions, Determinant General Definition, Properties of Determinants | p. 20 - 30 |
| 3 | 02.10.2025<br><br>02.10.2025 | Determinant Calculation | p. 31 - 35 |
| 4 | 09.10.2025<br><br>09.10.2025 | Inverse matrices: Three Lemmas, Theorem of Inverse Matrix, Calculation of Inverse Matrices by Elementary Transformations | p. 36 - 42 |
| 5 | 16.10.2025<br><br>16.10.2025 | Systems of linear equations: Matrix Rank, Basic Concepts, Gaussian Elimination, Homogeneous Systems of Linear Equations | p. 43 - 53 |
| 6 | 23.10.2025<br><br>23.10.2025 | Cramer's Rule, Cramer's General Rule | p. 54 - 59 |
| 7 | 30.10.2025<br><br>30.10.2025 | Vectors: Basic Definitions, Geometrical Interpretation | **Quiz (10 pts)** p. 60 - 65 |
| 8 | 06.11.2025<br><br>06.11.2025 | Resolution of Vectors into Components, Scalar Product of Vectors | p. 65 - 71 |
| 9 | 13.11.2025<br><br>13.11.2025 | **Midterm Exam** | p. 72 - 77 |

| | | Vector Product, The Scalar Triple Product, | |
|---|---|---|---|
| 10 | 20.11.2025

20.11.2025 | Transformation of Coordinates Under Rotation of the Coordinate System | p. 79 - 81 |
| 11 | 27.11.2025

27.11.2025 | Straight lines: Equations of lines, Lines in a Plane, Angle Between Two Lines | p. 82 - 89 |
| 12 | 04.12.2025

04.12.2025 | Distance From a Point to a Line, Relative Position of Lines | p. 89 - 90 |
| 13 | 11.12.2025
11.12.2025 | Planes: General Equation of a Plane, Equation of a Plane Passing Through Three Points, Other Forms of Equations of a Plane | **Quiz (10 pts)**

p. 91 - 95 |
| 14 | 18.12.2025

18.12.2025 | Angle Between Two Planes, Distance Between a Point and a Plane | p. 95 - 97 |
| 15 | 25.12.2025

25.12.2025 | Relative Position of Planes, Relative Position of a Plane and a Line, Angle Between a Plane and a Line | p. 97 - 98 |
| | **TBA** | **FINAL EXAM** | |

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