**Kazakh-British Technical University**

**School of Mathematics and Cybernetics**

**Approved**

**Head of Center of Mathematics**

**and Cybernetics**

**\_\_\_\_\_\_\_\_\_\_\_\_\_T.S. Kenzhebayev**

**Syllabus**

**Ordinary Differential Equations**

Semester: Autumn 2024

2024/2025 Academic Year

3 credits (2/0/1)

Name/Initials of the teacher: Arepova Gaukhar Dzhumabaevna

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Information about the teacher | Time and place of classes | | Contact information | |
| **Lessons** | Office hours (TSIS) | Tel.: | e-mail |
| PhD, associate professor | According to the schedule |  |  | arepovag@mail.ru |

**COURSE DURATION:** 3 credits, 15 weeks, 45 class hours

**COURSE DESCRIPTION**

This course provides an introduction to the theory, solution, and application of ordinary differential equations. Topics discussed in the course include methods of solving first-order differential equations, existence and uniqueness theorems, second-order linear equations, systems of equations, non-linear equations and applications. An introduction to numerical solutions is also provided. The goal of this course is to provide the student with an understanding of the solutions and applications of ordinary differential equations.

# Course Objectives:

• Solve first and second order linear homogeneous and non-homogeneous differential equations.

• Solve linear equations of second order with variable coefficients.

• Formulate and solve the Cauchy problem.

• Solve linear equations and systems with constant coefficients.

**Competencies** (learning outcomes):

At the end of the course, students are expected to:

• solve the boundary value problems;

• solve the Cauchy problem;

• solve the first and second order linear differential equations

• solve the systems of linear differential equations.

**REFERENCES**

**Main:**

[1]. William F. Trench. Elementary Differential Equations, 2013

[2]. William F.Trench. Elementary Differential Equations with Boundary Value Problems, 2013

[3]. William F.Trench. Student Solutions Manual for Elementary Differential Equation, 2013

#### COURSE CALENDAR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week** | **Class work** | | | | **HW**  [**https://xn--e1avkt.xn--p1ai/%d0%bc%d0%b0%d1%82%d0%b5%d0%bc%d0%b0%d1%82%d0%b8%d0%ba%d0%b0/%d0%a4%d0%b8%d0%bb%d0%b8%d0%bf%d0%bf%d0%be%d0%b2/**](https://xn--e1avkt.xn--p1ai/%d0%bc%d0%b0%d1%82%d0%b5%d0%bc%d0%b0%d1%82%d0%b8%d0%ba%d0%b0/%d0%a4%d0%b8%d0%bb%d0%b8%d0%bf%d0%bf%d0%be%d0%b2/) |
| **Topic** | **Lectures** | **Seminars** | **Chapters for reading** |
| 1 | Classifying Differential Equations. First Order Differential Equations. Separable Equations. | 2 | 1 | [1]Ch2. p.45-55 | Филиппов  решебник  51-61 |
| 2 | First Order Linear Differential Equations. Variation of Parameters. Integrating Factor. | 2 | 1 | [1]Ch2. p.83-96 | Филиппов  решебник  136-146 |
| 3 | Lagrange and Clairaut Equations. Implicit Differential Equations. | 2 | 1 |  | Филиппов  решебник  267-271, 287-296 |
| 4 | Bernoulli Equation.  Exact Equations. | 2 | 1 | [1]Ch2. p.63-64, 73-83 | Филиппов  решебник  186-193 |
| 5 | Numerical methods: Euler’s method. | 2 | 1 | [1]Ch3. p.96-109 |  |
| 6 | Second Order Linear Differential Equations with Constant Coefficients. The Method of Undetermined Coefficients. | 2 | 1 | [1]Ch5. p.210-248 | Филиппов  решебник  511-517, 533-542 |
| 7 | Second Order Linear Differential Equations with Variable Coefficients. | 2 | 1 | [1]Ch5. p.255-268 | Филиппов  решебник  681-691 |
| 8 | Midterm | 2 | 1 |  |  |
| 9 | Higher orders differential equations. Reduction of order. | 2 | 1 | [1]Ch5. p.248-255 | Филиппов  решебник  428-438 |
| 10 | Higher Order Linear Differential Equations with Constant Coefficients. The fundamental system of solutions. | 2 | 1 | [1]Ch9. p.476-488 | Филиппов  решебник  519-528, 587-588 |
| 11 | Higher Order Linear Differential Equations with Variable Coefficients. Variation of Parameters for Higher Order Equations. | 2 | 1 | [1]Ch9. p.498-508 |  |
| 12 | Linear Homogeneous Systems of Differential Equations with Constant Coefficients. | 2 | 1 | [1]Ch10. p.516-530 | Филиппов  решебник  786-796 |
| 13 | Method of Eigenvalues and Eigenvectors. | 2 | 1 | [1]Ch10. p.530-543 | Филиппов  решебник  826-836 |
| 14 | Variation of Parameters for Nonhomogeneous Linear Systems. | 2 | 1 | [1]Ch10. p.570-580 | Филиппов  решебник  846-850 |
| 15 | Endterm | 2 | 1 |  |  |

**COURSE ASSESSMENT PARAMETERS**

|  |  |
| --- | --- |
| Homework | 10 % |
| Quizzes | 20% |
| Midterm, endterm | 30 % |
| Final exam | 40 % |
| **Total** | **100 %** |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| № | Type of evaluation | Week | | | | | | | | | | | | | | | | Total |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16-17 |  |
| 1 | Midterm, endterm |  |  |  |  |  |  |  | \* |  |  |  |  |  |  | \* |  | 30 |
| 2 | Homework1, Homework2 |  |  |  |  |  |  |  | \* |  |  |  |  |  |  | \* |  | 10 |
| 3 | Quiz1, Quiz2 |  |  |  |  |  | \* |  |  |  |  |  |  | \* |  |  |  | 20 |
| 4 | Final exam |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \* | 40 |
|  | Total |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 100 |

**Grading Policy:**

KBTU Standard grading policy is used.

**Additional remarks:**

**-** Attendance (always be in time on lectures)

- Read main and additional materials

- Do homeworks

**Attention!** Attendance must be higher than 80%, student that does not attend without serious reason for more than 20% will receive a failing grade for that course. Student who plagiarizes on examinations will be failed.

Associate professor of Center of Mathematics and Cybernetics Arepova G.D.

Minutes # «1» 19 August, 2024