KAZAKH-BRITISH TECHNICAL UNIVERSITY

SCHOOL OF APPLIED MATHEMATICS

APPROVED BY

_____A.A. Issakhov

«____»_____ 2022

Syllabus
Ordinary Differential Equations
Semester: Autumn 2022
2022/2023 Academic Year
3 credits (2/0/1)

Instructor: Baishemirov Zharasbek Duisembekovich, associate professor

Personal Information about the Instructor	Time and place of classes		Contact information
	Lessons	Office Hours	e-mail
Ph.D., Associate Professor	According to the schedule	Wednesday, 17.00-19.00	zbai.kz@gmail.com

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

COURSE DESCRIPTION
Differential equations and Mathematical Analysis are the essential part of the mathematical background required of mathematicians, economists, engineers, physicists and other scientists. It is difficult to overestimate importance of the Mathematical Analysis for engineering students. This requirement reflects the importance and wide applications of the subject matter.

Course Objectives:
- The course is designed for IT students. It is the third part of the course of mathematical analysis. It contains the following chapters: line and surface integrals; integral theorems (Green's, Stoks's, and the divergence theorems); ordinary differential equations and systems of ordinary differential equations; elements of stability theory; and applications of differential equations to the Circuit Theory.
- The course is destined for students studying mathematics. It includes 4 parts:
- 1) First-order differential equations
- 2) Applications of differential equations
- 3) Linear differential equations of higher-order
- 4) Systems of linear differential equations.

Competencies (learning outcomes):
At the end of the course, students are expected to:
- evaluate the problems of vector analysis;
- solve the problems of ordinary differential equations;
- apply the linear differential equations to applied problems.

Prerequisites: Calculus 2
Post-requisitions: Algorithms and programming languages, Data analysis

REFERENCES

Main Textbooks

[1] ***George B. Thomas, Maurice D. Weir, Joel R. Hass.*** Thomas' Calculus. — 12th ed.

[2] ***George B.Thomas.Jr.,Ross L.Finney.*** Calculus and analytic geometry. — 11th ed. 2006.

[3] ***W.E. Boyce, R.C. DiPrima.*** Elementary Differential Equations and Boundary Value Problems. — 7th ed. John Wiley & Sons, Inc. 2001.

[4]. ***Рябушко А.П.*** Сборник индивидуальных заданий по высшей математике. Минск: Образование и наука. 2002.

[5]. ***William F. Trench.*** Elementary Differential Equations, 2013.

Supplementary

[6] Student's Solution Manual for Thomas/Finney Calculus. — 11th ed. 2006.

[7] ***Walter Rudin.*** Principles of Mathematical Analysis. — 3rd ed. 1976.

[8] ***Матвеев Н.М.*** Дифференциальные уравнения. Л.: Изд-ва Ленинградского университета, 1965.

[9] ***Матвеев Н.М.*** Методы интегрирования обыкновенных дифференциальных уравнений. М.: Высшая школа, 1967.

[10] ***Лизоркин П.И.*** Курс дифференциальных и интегральных уравнений с дополнительными главами анализа. М. Наука, 1981.

[11] ***Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer.*** Analysis and design of analog integrated circuits. Fourth edition. John Willey and Co. 2000.

COURSE CALENDAR

Day №	Content of lecture (2 hour per lesson)	References & Hometasks
1	**Topic 1.** Vector valued functions and motion in space. Curves in space and their tangent. Integral of vector functions.	**[1].** Ch. 13, p. 707–724
2	**Topic 2.** Arc length in space. Curvature and Normal vectors of a curve. Tangential and Normal components of acceleration. Torsion. Frenet frame. Velocity and acceleration in polar coordinates.	**[1].** Ch. 13, p. 724-746
3	**Topic 3.** First-order differential equations. Basic definitions and terminology. Separable variables. Homogeneous equations.	**[1].** Ch. 9, p. 496–516
4	**Topic 4.** Exact equations. Integrating factor.	**[1].** Ch. 18 (16), p. 516–529.
5	**Topic 5.** Linear equations. Equations of Bernoulli.	[8]. Глава 1, §4–7, С. 60–95
6	**Topic 6.** Numerical method, Euler's Method Modeling with first-order differential equations; Linear models	[8]. Глава 1, §4–7, С. 60–95
7	**Midterm**	
8	**Topic 7.** Nonlinear models	[3]. Ch. 2.6, 94–101. [8]. Глава 1, §11–13, С. 96–112
9	**Topic 8.** Modeling with Systems of First-Order DEs	[2] Ch.5. p.194-255
10	**Topic 9.** Linear second-differential equations. Initial-value and boundary-value problems. Linear dependence and linear independence. Solutions of linear equations.	[3]. Ch. 3, 135–191.Ch. 4, 219–242.
11	**Topic 10.** Constructing a second solution from a known solution. Homogeneous linear equations with constant coefficients.	[3]. Ch. 3, 135–191.Ch. 4, 219–242.
12	**Topic 11.** Method of undetermined coefficients. Method of variation of parameters.	[2] Ch. 10. p.508 – 570.
13	**Topic 12.** Systems of linear differential equations.	[2] Ch. 10. p.508 – 570.
14	**Endterm**	[7]. Глава 2, С. 68–95.
15	**Final**	

COURSE ASSESSMENT PARAMETERS

Attendance	0 %
Activity on lessons	0 %
Midterm (or endterm)	60 %
Final exam	40 %
Total	**100 %**

No	**Assessment criteria**	**Weeks**																**Total**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16 17**	
1.	Attendance	has to be more than 80%																
2.	Activity on lessons		2	2		2	2		2	2	2		2	2		2		**20**
4.	Midterm (or endterm)				10			10				10			10			**40**
5.	Final examination																40	**40**
	Total		*2*	*2*	*10*	*2*	*2*	*10*	*2*	*2*	*10*	*10*	*2*	*2*	*10*	*2*	*40*	**100**

Lectures are held online via Microsoft Teams, **practices** are held in the walls of KBTU or online depending on COVID-19 situation. Lectures are conducted in the form of explaining theoretical material while students are supplied with handouts uploaded into the intranet. Practices should be dedicated to honing skills in mathematics.

Grading policy:
Intermediate attestations (on 7^{th} and 14^{th} week) join topics of all lectures, laboratories, homework, quiz and materials for reading discussed to the time of attestation. Maximum number of points within attendance, activity, homework, quiz and laboratories for each attestation is 30 points. Every intermediate attestation and quiz is held during practice hours in the university or online using "kbtu.proctoring.online" website as well as any other proctoring service.
Final exam joins and generalizes all course materials, is conducted in the complex form with questions and problems. Final exam duration is 120 min. Maximum number of points is 40. At the end of the semester you receive overall total grade (summarized index of your work during semester) according to conventional KBTU grade scale. Final exam is going to be an online event with use of online proctoring service provided by the university.

ACADEMIC POLICY
Students are required:

- to be respectful to the teacher and other students;
- to switch off mobile phones during classes;
- DO NOT cheat. Plagiarized papers shall be graded with zero points;
- to come to classes prepared and actively participate in classroom work; to meet the deadlines;
- to enter the room before the teacher starts the lesson;
- to attend all classes. No make-up tests or quiz are allowed unless there is a valid reason for missing it;
- to follow KBTU academic policy regarding **W, AW, I, F** grades;
- When students are absent for 20% of the lessons or more (without the document that confirms an appropriate reason), then their grade is F;

- When students have a score of 29 or less for attestation 1 added to attestation 2, then their grade is F;
- When students have a score of 19 or less (less than 50%) for their final exam, then their grade is F;
- When students do not come for their final exam, then their grade is F.

Students are encouraged to

- consult the teacher on any issues related to the course;
- make up within a week's time for the works undone for a valid reason without any grade deductions;

Considered in meeting of School of Applied Mathematics, minutes №___ «___»_____2022 year.

Teacher _____Zh.D.Baishemirov