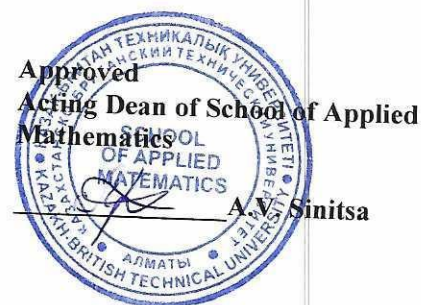


**KAZAKH-BRITISH TECHNICAL UNIVERSITY
SCHOOL OF APPLIED MATHEMATICS**



**Syllabus
Calculus 1**

Semester: Autumn 2023
2023/2024 Academic Year
3 credits (1/0/2)

Instructor: Beibut Shaiykovich Kulpeshov, professor

Personal Information about the Instructor	Time and place of classes		Contact information	
	Lessons	Office Hours	Tel.:	e-mail
professor	According to the schedule			b.kulpeshov@kbtu.kz

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

COURSE DESCRIPTION

The goals of the course are to familiarize students with the important branches of Calculus.

Course Objectives:

Calculus is the essential part of mathematical background required of mathematicians, economists, engineers, physicists and others. It is difficult to overestimate the importance of the Mathematical Analysis for engineering students. This course gives basic tools of calculus to the students specializing in mathematical modeling. Upon successful completion of this course, Students will be able to:

- operate with the limits of sequences and functions
- evaluate the derivatives of functions
- evaluate the indefinite integrals
- find the extrema of scalar-valued functions of one variable

Competencies (learning outcomes):

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

- evaluate the limits;
- evaluate the derivatives of explicitly or implicitly given functions;
- apply the derivatives to extreme problems
- evaluate indefinite integrals.

Prerequisites: –

Post-requisites: Calculus-2, Probability Theory and Mathematical Statistics

REFERENCES

Main:

1. George B. Thomas Jr., Maurice D. Weir, Joel Hass. Thomas' Calculus (early transcendentals), 13th edition, Pearson, 2014, 1205 pages.
2. Vladimir A. Zorich, Mathematical Analysis 1. Springer-Verlag, 2003, 597 pages.

Supplementary:

3. B.P. Demidovich, Collection of Problems and Exercises in Mathematical Analysis, Moscow: Moscow University, 13th edition, 1997, 624 pages (in Russian).

COURSE CALENDAR

Week	Class work				SIW (student's individual work)	
	Topic	Lectures	Seminars	Chapters for reading		
1	Numbers, Sets and Functions: Numbers. Sets and elementary operations on them. Intervals. Functions. Domain and range of a function.	2	1	[1], AP, pp. 1-6; Ch. 1, pp. 1-51. Problem Set: pp. 11-53.		
2	Limit of a Function and Limit Laws: Limits of polynomials. Sandwich Theorem. One-sided limits.	2	1	[1], Ch. 2, pp. 66-73, 77-83, 86-91. Problem Set: pp. 74-76, 83-85, 91-93.		
3	Continuity. Points of Discontinuity: Continuity at a point. Continuity test for an interior point. Continuous functions. Uniform continuity.	2	1	[1], Ch. 2, pp. 93-102; [2], Ch. 4, pp. 162-164; [3], pp. 90-91. Problem Set: [1], pp. 102-103; [3], pp. 92-93.		
4	Limit Involving Infinity. Asymptotes of Graphs: Finite limits as $x \rightarrow \pm\infty$. Horizontal asymptotes. Oblique asymptotes. Infinite limits. Vertical asymptotes.	2	1	[1], Ch. 2, pp. 104-115. Problem Set: pp. 115-117.		
5	Derivatives, Tangents. Derivative at a point: Finding a tangent to the graph of a function. Alternative formula for derivative. One-sided derivatives. Differential rules.	2	1	[1], Ch. 3, pp. 123-125, 128-132, 136-144, 156-160. Problem Set: pp. 126-127, 133-135, 144-145, 160-161.		
6	Differential Calculus: Chain Rule, Implicit Differentiation, Rule for Inverses: Derivatives of higher order. Tangents and normal lines. Logarithmic differentiation. The number e as a limit.	2	1	[1], Ch. 3, pp. 163-168, 171-174, 177-185. Problem Set: pp. 168-169, 175-176, 185-186.		
7	Linearization and Differentials: Estimating with differentials. Error in differential approximation. Inverse trigonometric functions.	2	1	[1], Ch. 3, pp. 202-211, 187-191. Problem Set: pp. 211-212, 192-193.		

8	Application of Derivatives: Extreme values of functions, Monotonicity: Rolle's theorem. Mean value theorem. First derivative test.	2	1	[1], Ch. 4, pp. 223-228, 231-236, 239-242. Problem Set: pp. 228-230, 237-238, 242-244.	
9	Convexity, Concavity and Curve Sketching. Procedure for Graphing: Second derivative test. Points of inflection.	2	1	[1], Ch. 4, pp. 244-252, Problem Set: pp. 252-254.	
10	Indeterminate Forms. L'Hopital's Rule. Cauchy Mean Value Theorem: Indeterminate powers.	2	1	[1], Ch. 4, pp. 255-261, Problem Set: pp. 262-263.	
11	Antiderivatives. Indefinite Integrals. Riemann Sums. Definite Integrals: Initial value problems and differential equations. Area under the graph of a nonnegative function.	2	1	[1], Ch. 4, pp. 281-286, Ch. 5, pp. 313-324 Problem Set: pp. 287-289. pp. 324-326.	
12	Fundamental Theorem of Calculus. Substitution Method: Mean value theorem for integrals. Total area.	2	1	[1], Ch. 5, pp. 328-336, pp 339-345. Problem Set: pp. 336-337, 345-346.	
13	Definite Integral Substitutions. Techniques of Integration: Areas between curves. Integration by parts.	2	1	[1], Ch. 5, pp. 347-353; Ch. 8, pp. 461-467. Problem Set: pp. 353-356, pp. 467-469.	
14	Trigonometric Integrals. Integration of Rational Functions: Products of sines and cosines. Trigonometric substitutions. Integration of rational functions by partial fractions.	2	1	[1], Ch. 8, pp. 469-487, Problem Set: pp. 474-488.	
15	Improper Integrals: Infinite limits of integration. Integrands with vertical asymptotes. Tests for convergence and divergence.	2	1	[1], Ch. 8, pp. 504-512, Problem Set: pp. 513-515.	

COURSE ASSESSMENT PARAMETERS

Attendance	8 %
Homework	14 %
Quizzes (midterm, endterm)	38 %
Final exam	40 %
Total	100 %

No	Assessment criteria	Lessons																Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16 - 17	
1.	Attendance	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	
2.	Quizzes (midterm, endterm)				9			10			9				10			8
3.	Homework		1	1	1	1	1	1	1	1	1	1	1	1	1	1		38
4.	Final examination																	14
	Total																40	40
																		100

Lectures are conducted in the form of explaining the theory given in the course that is why students supplied with handouts uploaded into the intranet. Activity and attendance on lessons is mandatory. Mandatory requirement is preparation for each lesson.

Homework requirements: Homework must be submitted on time. For example, if a homework is given at a practical lesson, it must be completed and submitted before the start of the next practical lesson (that is, exactly 1 week is given to complete the homework). A homework completed and submitted on time is estimated at exactly 1 point. If the work is not submitted on time, then the mark for homework is reduced: if the delay is up to one week, then the work is estimated at 0.5 points; if the delay is more than one week to two weeks - 0.25 points, etc. If a homework is not submitted at all, then one point is subtracted from the overall grade for the discipline for each non-submitted homework.

Grading policy:

Intermediate attestations (on 4th, 7th, 10th and 14th lessons) join topics of all lectures, homework, quiz and materials for reading discussed to the time of attestation. Maximum number of points for each attestation is 9-10 points.

If studying will be online then all the methods of monitoring the current progress of students (quizzes, midterm, endterm and final exam) will be carried out using the proctoring system Proctor Edu.

Final exam joins and generalizes all course materials, is conducted in written form with exercises. Final exam duration is 120 minutes. 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.

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 30% of the lessons or more (without Certificate of temporary disability), 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;

Professor of School of Applied Mathematics
Minutes # «1» 23 August, 2023



B.Sh. Kulpeshov