

Syllabus Mathematical Analysis I

1. GENERAL INFORMATION	
Faculty	Information Technology
Major code and title	5B060200 Computer Science
Year, semester	1 st year, 1 st semester
Subject category	Compulsory
Number of Credits	3
Language of Delivery	English
Prerequisites	None
Postrequisites	Mathematical Analysis 2
Lecturer	Roza E. Uteshova, assistant professor, candidate of physical and mathematical sciences Room 808, e-mail: r.uteshova@iitu.kz Office hours: Wednesday, Thursday 12.00-14.00
Instructors	Roza E. Uteshova
2. GOAL AND OBJECTIVES OF THE COURSE	
<p>The goal of the course is that at the end of the course, students are able to know and master, from the point of view of users, the concepts and fundamental techniques of mathematical analysis.</p> <p>The objectives of the course are to:</p> <ul style="list-style-type: none"> • Introduce fundamental ideas of calculus of a single variable function including limits, continuity, derivative, indefinite integral. • Apply the fundamental concepts of calculus to a variety of applications <p style="text-align: center;">Learning outcomes of the course</p> <p>Students successfully completing the course will be able to:</p> <ul style="list-style-type: none"> • evaluate various limit problems and check the continuity of various types of functions; • differentiate various types of functions using the differentiation rules and apply differentiation to find linear approximation, extrema, monotonicity, and concavity of functions; • use a variety of mathematical techniques to evaluate integrals. 	
3. COURSE DESCRIPTION	
<p>Mathematical Analysis 1 is the first course in a two-semester sequence. The primary aim of the sequence is to help students learn, understand, explain, and use calculus. In addition, it is desired that students will improve their mathematical skills, further their understanding of mathematics and its applications to the sciences. This first course concentrates on single variable functions, their limits, continuity, differential and integral calculus.</p>	
4. COURSE POLICY	
<p>Students are forbidden to:</p> <ul style="list-style-type: none"> - submit any tasks after the deadline. Late submissions are graded down. - cheat. Plagiarized papers shall not be graded; - be late for classes; - retake any tests, unless there is a valid reason for missing them; - use mobile phones in class. <p>Students should always</p> <ul style="list-style-type: none"> - be appropriately dressed (formal/semi- formal styles are acceptable); - show consideration for and mutual support of teachers and other students; 	

- let the teacher know of any problems arising in connection with their studies.

5. Literature

Basic literature:

1. H. Anton, I. Bivens, S. Davis. *Calculus. Early Transcendentals*. 10th ed. 2012.
2. *Problems in Mathematical Analysis*. Under the editorship of B.P. Demidovich. Mir Publishers, Moscow, 1965.
3. A.P. Ryabushko. *Collection of Individual Assignments in Higher Mathematics*. Minsk: Vysh.shkola, 2011

Supplementary literature:

1. Robert A. Adams, Christopher Essex. *Calculus: A Complete Course*. 9th ed. 2013.
2. W.W.L. Chen, *Fundamentals of Analysis*, 2008

6. Course Content

6.1 Lecture, practical/seminar/laboratory session plans

Abbreviation	Meaning
TSIS	Teacher supervised independent work (CPCII)
SIS	Students' independent work (CPC)
IHW	Individual homework
PA	Practical assignment

Week No	Course Topic	Reference Materials	Lectures (1 h/w)	Practice work (2 h/w)	TSIS (2 h/w)	SIS (4 h/w)
1	The subject of Mathematical Analysis. Sets and operations over them. Functions.	Basic [1]-[3]	L 1	PS 1	TSIS 1	SIS 1
2	Numerical sequences. Bounded and unbounded sequences. Limit of a sequence. Basic properties of convergent sequences.	Basic [1]-[3]	L 2	P 2	TSIS 2	SIS 2
3	Monotone sequences. The number e. Subsequences. Bolzano-Weierstrass lemma.	Basic [1]-[3]	L 3	PW 3	Quiz 1	
4	Limit of a function. Properties of the limit of a function. Remarkable limits. Comparison of infinitely small quantities.	Basic [1]-[3]	L 4	PW 4	TSIS 3	SIS 3
5	Continuous functions. Continuity of elementary functions. Basic properties of continuous functions.	Basic [1]-[3]	L 5	PW 5	TSIS 4	SIS 4
6	Derivative of a function. Physical and geometrical meaning of the derivative. Tangent line. Table of derivatives and differentiation rules.	Basic [1]-[3]	L 6	PW 6	Quiz 2	
7	Differentiation of a composite function. Differentiation of an inverse function. Differential of a function.	Basic [1]-[3]	L 7	PW 7	TSIS 5	SIS 5

8	Theorems about differentiable functions (Rolle, Lagrange, Cauchy). L'Hospital rule.	Basic [1]-[3]	L 8	PW 8	Mid-term	
9	Higher-order derivatives and differentials. Intervals of monotonicity. Extremal points. Concave and convex functions. Points of inflection.	Basic [1]-[3]	L 9	PW 9	TSIS 6	SIS 6
10	Asymptotes. General scheme of analysis of a function and construction of its graph.	Basic [1]-[3]	L 10	PW 10	TSIS 7	SIS 7
11	Taylor's formula. The Maclaurin formula for some functions.	Basic [1]-[3]	L 11	PW 11	Quiz 3	
12	Antiderivative. Indefinite integral and its properties. Table of basic integrals.	Basic [1]-[3]	L 12	PW 12	TSIS 8	SIS 8
13	Integration by substitution. Integration by parts.	Basic [1]-[3]	L 13	PW 13	Quiz 4	
14	Integration of rational functions.	Basic [1]-[3]	L 14	PW 14	TSIS 9	SIS 9
15	Integration of irrational and trigonometric functions.	Basic [1]-[3]	L 15	PW 15	End-of-term	
Total hours		135	15	30	30	60

6.2 List of assignments for Student Independent Study

№	Assignments (topics) for Independent study	Hours	Recommended literature and other sources (links)	Form of submission
1	Elementary functions.	6	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
2	Number sequence. Limit of a sequence.	6	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
3	Limit of a function.	6	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
4	Continuity of a function. Points of discontinuity.	8	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
5	Differentiation rules.	8	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
6	Differential. L'Hopital rule.	6	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
7	Applications of derivatives.	8	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
8	Techniques of evaluating definite integrals	6	Basic [1]-[3] Supplementary [1][2]	Submission of IHW
9	Integration of rational functions	6	Basic [1]-[3] Supplementary [1][2]	Submission of IHW

7. Student performance evaluation system for the course

Period	Assignments	Number of points	Total
1 st attestation	Class work: Regular attendance\Active participation	40 10	100

	Quiz # 1	15	
	Quiz # 2	15	
	Student Independent Study:	35	
	Individual Home Work # 1	5	
	Individual Home Work # 2	10	
	Individual Home Work # 3	10	
	Individual Home Work # 4	5	
	Individual Home Work # 5	5	
	Mid term	25	
2 nd attestation	Class work:	40	100
	Regular attendance\Active participation	10	
	Quiz # 3	15	
	Quiz # 4	15	
	Student Independent Study:	35	
	Individual Home Work # 6	5	
	Individual Home Work # 7	10	
	Individual Home Work # 8	10	
	Individual Home Work # 9	10	
	End of term	25	
Final exam	Exam	100	100
Total	0,3*1stAtt+0,3*2ndAtt+0,4*Final		100

*If the number of absences exceeds 20%, student will be automatically scheduled for a Retake (summer semester)

Achievement level as per course curriculum shall be assessed according to the evaluation chart adopted by the academic credit system:

Letter Grade	Numerical equivalent	Percentage	Grade according to the traditional system
A	4,0	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3,0	80-84	
B-	2,67	75-79	
C+	2,33	70-74	Satisfactory
C	2,0	65-69	
C-	1,67	60-64	
D+	1,33	55-59	
D	1,0	50-54	Fail
F	0	0-49	

8. METHODOLOGICAL GUIDELINES

Assessment is administered continuously throughout the course. The students are rated against their performance in **continuous rating** administered throughout the semester (credited 60%) and **summative rating** done during the examination session (credited 40%), total **100%**. **Continuous rating** is students' on-going performance in class and independent work. Class work is assessed for attendance and active participation (problem solving).

Teaching methodology

Theory classes:

- lectures developing the theoretical aspects of the subject

- practical classes aimed at applying theory to problems.
- Workshop classes:
- practical classes in which students solve problems in groups or individually.

SIS (Student Independent Study) comprises topics related problems to be done by students independently and checked in class.

TSIS (Teacher Supervised Student Independent Study) comprises individual homework assignments to be done by students independently and checked by teacher.

Mid-term examination is held in the 8th week of the semester and includes topics 1-7 of the course.

End-of-term examination is held in the last week of the semester and includes topics 8-15 of the course.

Final examination is a computer-based test that consists of multiple choice questions covering all topics of the course.