

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РЕСПУБЛИКИ КАЗАХСТАН



Approved by

Director of Project management Institute
Aldashev A. _____

Director of Scientific and Educational
center of mathematical economics
Aubakirova S. _____

« ____ » _____ 20 ____ г.

SYLLABUS

Satbayev University, NSE
Academic Year 2019-2020
Spring 2020

Discipline: Abstract Mathematics

Credits: 3

Course/Syllabus designer: Prof. Sergey Khrushchev

Date: January 08, 2020

Almaty, 2020

**МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РЕСПУБЛИКИ КАЗАХСТАН**

**Satbayev University
New School of Economics (NSE)**

Course: Abstract Mathematics, Code: MT 2116 (3 credit hours)

Spring Semester, 2020

Prerequisites:

MT 1173, MT 1174

Location: Room Time:

Instructor: Prof. S.V.Khrushchev

Instructor	Time and venue		Contact	
	Classes	Office hours	Tel.:	e-mail
Professor, Doctor of Science in Math & Physics	Tuesday 10-13, 223	Office 403	mobile: 8 778 970 01 64	s.khrushchev @satbayev.university

Course description

The course is destined for students studying economics. It includes six parts: 1) Supremum and infimum, 2) Sequences and limits, 3) Limits of functions and continuity, 4) Groups, 5) Subgroups, 6) Homomorphisms and Lagrange's theorem.

The main aim of the course is to enable students to acquire skills in the methods of algebra and analysis, as required for their use in further mathematics subjects and economics-based subjects; to prepare students for further courses in mathematics and/or related disciplines

Learning outcomes

At the end of this course and having completed the reading and activities you should have:

- a) have used basic mathematical concepts in discrete mathematics, algebra and real analysis to solve mathematical problems in this subject;
- b) be able to use formal notation correctly and in connection with precise statements in English ;
- c) be able to demonstrate an understanding of the underlying principles of the subject;
- d) be able to prove statements and formulate precise mathematical arguments.

Textbook: 1. Biggs, Norman L. Discrete Mathematics. (Oxford Press: Oxford, 2002) 2nd ed, ISBN 9780198507178).

2. Eccles, P.J. An Introduction to Mathematical Reasoning: numbers, sets and functions. (Cambridge University Press: Cambridge and New York, 1997) [ISBN 9780521597180].

3. Lay S.R. Analysis with an Introduction to Proof, 5th ed (Pearson 2014, ISBN 9781292040240, 365pp)

**МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РЕСПУБЛИКИ КАЗАХСТАН**

4. Andriescu T., Andrica D. Complex Numbers from A to ... Z, 2nd ed (Birkhauser ISBN 9780817684143, 406pp)

5. Sasane A. The How and Why of One Variable Calculus (Wiley, 2015) [ISBN 9781119043386].

6. Bryant V. Yet Another Introduction to Analysis. (Cambridge University Press: Cambridge and New York, 1990) [ISBN 9780521388351].

Further Reading:

3. Binmore K.G. Mathematical Analysis: A Straightforward Approach. (Cambridge University Press: Cambridge, 1982)

4. Bartle R.G., Sherbert D. R. Introduction to Real Analysis. 4th ed (Wiley 2011, ISBN 9780471433316, 418pp)

Planned Schedule:

Week	Classes				Assignments
	Topic	Lecture	Practice	Textbooks	
1.	Divisibility and prime numbers. Quotient and remainder, Representation of integers, The greatest common divisor, Prime numbers, Existence and Uniqueness of Prime Factorization, The Fundamental Theorem of Arithmetic	2	1	[1], pp. 65-75 [2], pp. 189-228 [3], pp. 107-111	Jan 21
2	Congruence and Modular Arithmetic, Z_m and its Arithmetic, Invertible Elements of Z_m , Euler's Theorem, Fermat's Theorem	2	1	[1], pp. 142-158 [2], pp. 229-298, [3], pp. 111-125	Jan 28 Assignment01
3	Rational Numbers and Real Numbers. Rational numbers as equivalence classes, Rationality and repeating patterns, Continued Fractions, Irrational numbers, Density of Rational Numbers	2	1	[1], pp. 75-83	Feb 4 Assignment02
4	Complex Numbers. Complex numbers as equivalence classes. Complex numbers and Cartesian coordinates, Roots of polynomials The complex plane, polar form, exponential form	2	1	[4], pp. 1-55	Feb 11 Quiz 1
5.	Supremum and Infimum. Bounded sets, maximum and minimum, the least upper bound property, the greatest upper bound property, applications, examples and problems, Dedekind sections	2	1	[1] 84-88 [5], pp. 3-11, [6], pp. 1-28	Feb 18 Assignment03
6.	Sequences. Examples, the limit of a convergent sequence, bounded and monotonic sequences, applications, algebra of limits, Sandwich theorem	2	1	[5] pp. 45-74 [6] pp. 24-74	Feb 25 Quiz 2

**МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РЕСПУБЛИКИ КАЗАХСТАН**

	Subsequences. Properties and Examples, Bolzano-Weirstrass Theorem.				
7.	Limits of Functions. Pointwise and uniform convergence, applications of uniform convergence. Continuous Functions. Continuity and sequences, continuous functions on closed intervals. The Intermediate Value Theorem.	2	1	[5] pp. 27-124 [6] pp. 75-142	March 3 Assignment 4 Quiz 3
8.	Mid-term exam				March 10
9.	Groups. Definition, binary operations, examples, Group Tables. Elementary properties of groups	2	1	[1] pp. 259-295,	March 17 Quiz 4
10.	Subgroups. Definition, powers and orders of a group element, examples.	2	1	[1] pp. 259-295	March 24
11.	Homomorphisms and Lagrange's theorem. Homomorphisms, isomorphisms, cosets, Lagrange's theorem	2	1	[1] pp. 359-295	March 31
12.	Revision	2	1		April 7
13.	Mock Exam 2	2	1		April 14
14.	Mock Exam 3				April 21
15.	Final exam				April 27 – May 2

Evaluation criteria:

Mock exams	16%
Quizzes	16%
Assignments	8%
Mid-term exam	20%
Final exam	40%
<i>Total points</i>	100%

Attendance and activity at classes is one of the components of your total grade. If a student is late for a class or leaves class before the end at least twice, then it is equivalent to one missed class independently of a reason.

Quizzes of 60 min duration will be given at practice. The total number of quizzes is 3 accordingly with the number of topics.

**МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РЕСПУБЛИКИ КАЗАХСТАН**

3 assignments will be given at practice. A student may be asked by teacher to explain submitted solutions.

Mid-term exam includes three chapters: Real Numbers, Sequences, Continuity. The questions contain both theoretical and practical problems.

Final exam includes whole course material. It is conducted in written form. The duration of final exam is 3 hours. No additional questions to the main question card are provided for increase of the final result. No retake exam is provided.

Grade policy: The final grade will be calculated in accordance with the General Scale of KBTU.

Course policy and ethic rules :

- don't miss and be late for classes;
- switch off your mobile phones during classes;
- if you miss quiz or exam due a valid reason you should notify the teacher in advance;
- prompting and copying off are not allowed; a student exposed in that will be evaluated by "F";
- calculators may not be used during exams and quizzes, however, it is recommended to use TI-nspire CX CAS (your calculators for Calculus AP) to check your calculations beyond the time of exams.

Time schedule of graduating

№	Form of the control	Week																Points	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
1	Mock exam and activity			*										*	*				16
2	Quizzes				*		*	*		*									16
3	Assignments		*	*		*		*											8
4	Mid-term exam								*										20
5	Final exam																	*	40
	<i>Total points</i>																		100

GRADING SCALE:

Total Points	Grade	Equivalent GPA
95 – 100	A	4.0
90 – 94.9	A-	3.7
85 – 89.9	B+	3.3
80 – 84.9	B	3.0
75 – 79.9	B-	2.7
70 – 74.9	C+	2.3
65 – 69.9	C	2.0
60 – 64.9	C-	1.7
55 – 59.9	D+	1.3
50 – 54.9	D	1.0
Less than 50	F	0.0

Students who missed more than 20% of the classes without a documented reason shall receive a letter grade "F" (Fail). Students who received only 30% of the total grade before the final exam shall not be allowed to take one. Students are required to receive at least 50% on the final examination to pass the course. If a student receives less than 50% on the final exam, (s)he shall receive a letter grade "F" (Fail)

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН

HOMEWORK ASSIGNMENTS

All the homework assignments must be done by you only. You can discuss your homework with other students but the write-up must be done independently. No late homework assignment will be accepted. In fact, most of the assignments are electronic.

KBTU INTRANET

You will be required to access the KBTU Intranet regularly. I suggest visiting this site at least every other day. Go to the KBTU's web site and there click on the "Intranet" link. All homework assignments, solutions to them, quiz material, grades, articles to submit will be posted on the Intranet.

ACADEMIC HONESTY

All students are expected to practice academic honesty in and out of class. Instances of academic dishonesty can result in a student receiving a letter grade of "F" for the course and referral to University judicial organizations, for possible expulsion. Academic dishonesty includes, but is not limited to, plagiarism, cheating on exams, and obtaining unauthorized assistance in completing exams and assignments.

CELL PHONES, PAGERS, LAPTOPS, & CALCULATORS POLICY

You are responsible to see it that your cell phone does not ring during class. Should your phone ring in class, you will be asked to leave class. In addition, after the first infraction, you will be asked to leave class and will receive 'Absence' for attendance in the Intranet journal for each time your phone rings. Please be considerate of your classmates and teacher and avoid this problem. The ISE does not allow students to use laptops during the class sessions unless a student is given a special permission (due to disability). You are not allowed to use cell phones, pagers or programmable calculators during the tests; therefore, bring a calculator to every class.

LEARNING ASSISTANCE

The ISE at KBTU wants to be certain you have access to as many learning aids as possible. Here are some ways you can supplement your classroom experience. The tutorial sessions with myself will provide necessary assistance through extended practice. You can also see me during my office hours for additional assistance which is the best way to get helped.

If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please contact the ISE Dean. You can contact her by calling: 7-727-272-39-72 or sending an email to: tk.82@mail.ru. Once you have received your accommodation letters, please meet with me to discuss the provisions of those accommodations as soon as possible.

EXAMS

All students must take the exams at the scheduled times. Please make travel and other plans accordingly. This is especially true for the final exams. The final exams are cumulative. All students must take final exams. Do not plan traveling if you expect bad weather conditions or problems with buying tickets; failure to take your quiz or exam because of these reasons is totally your responsibility. No make-up exam will ever be given except for the cases described below.

I never give make-up quizzes nor do I accept late homework. Only if you provide a letter from a doctor or the Dean of the ISE explaining the reason of your absence can you take a make-up quiz but only before the class following the official date of quiz (this does not however guarantees that you will actually be able to do that due to various schedule conflicts). It is a sole responsibility of a student to get all the necessary material and to submit required work on time in case of absence in class.

Should a class be cancelled on the day of an exam, the exam will be held during the next scheduled class. Should you miss a midterm or final exam, you will need to provide a letter from the Dean of the ISE explaining why you should be allowed to make up that exam. Failure to do so will result in a grade of "F" for that exam and zero points will be awarded.

**МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РЕСПУБЛИКИ КАЗАХСТАН**