Syllabus
Mathematical Analysis III

1. GENERAL INFORMATION ABOUT THE COURSE	
Faculty	Information Technology
Major code and title	5B050700 Mathematical and Computer Modeling
Year, semester	2nd year, 3rd semester
Subject category	Elective
Number of Credits	3
Prerequisites:	Mathematical Analysis 2, Analytic Geometry
Postrequisites	Equations of Mathematical Physics
Lecturer	Rosa Uteshova, Assistant-Professor, Candidate of Physical and Mathematical Sciences, office: 808, e-mail: r.uteshova@iitu.kz Office hours: Monday, Wednesday 13.00 – 15.00
Instructors	Roza E. Uteshova

2. GOALS AND OBJECTIVES OF THE COURSE

The goals of the course. Mathematical analysis is a vast area of mathematics with a specific object of study (a variable), a peculiar research method (analysis by infinitesimal or by limiting transitions), a certain system of basic concepts (function, limit, derivative, differential, integral, infinite series) and constantly improving and developing apparatus, which is based on the differential and integral calculus. Mathematical analysis is one of the major courses for students majoring in MCM. It provides a framework for modeling systems in which there is change, and a way to deduce the predictions of such models. Students are expected to have a clear understanding of the ideas of Mathematical analysis as a solid foundation for subsequent courses in mathematics and other disciplines as well as for direct application to real life situations.

Course objectives are to provide students with the basic knowledge of differential and integral calculus of function of several variables and vector calculus.

Learning outcomes

After successful completing of this course the students should

be able to:

- understand the concepts of the limit and continuity of a function of several variables, partial derivatives and differentials, gradient and directional derivatives, implicit functions and their differentiation, double, triple integrals, line and surface integrals, basic characteristics of vector fields.
- calculate partial derivatives and differentials of functions of several variables
- find equations of tangent planes and normal lines, gradients and directional derivatives, extreme values of functions of two variables
- evaluate double, triple, line and surface integrals and use them to find areas, volumes, surface areas, etc

be qualified in

- ability to write mathematical statements and problem solutions using mathematical symbols
- understanding of key mathematical concepts and the application of appropriate tools to real problems
- ability to retrieve from different sources and analyze information required to solve scientific and practical tasks.

3. COURSE DESCRIPTION

Mathematical Analysis 3 is the third course in a three-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 third course concentrates on functions of several variables, limit and continuity, partial differentiation, multiple integration, vector fields.

4. COURSE POLICY

Students are forbidden to:

- 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.

Students should always

- 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

Required literature:

1. Piskunov N.S. Differential and Integral Calculus. V.II. Moscow: Mir Publishers
2. Robert A. Adams, Christopher Essex, Calculus: a compete course, 7th edition, Pearson Canada Inc., 2010.
3. B. Demidovich, *Problems in Mathematical Analysis*, M., Mir Publishers.
4. Ryabushko A.P. Collection of individual tasks in higher mathematics. 1990.

Supplementary literature:

1. Tom M. Apostol, Calculus, Volume -2, New – York, 1969
2. H. Anton, I. Bivens, S. Davis. *Calculus*. J.Wiley & Sons, inc. 2009
3. 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 Topics	Reference Materials	Lectures (1 h/w)	Practical classes (2 h/w)	TSIS (2 h/w)	SIS (4 h/w)
1	Functions of several variables. Graphs. Level curves.	1, Ch. 8	1	2	2	4
2	Limit and continuity of a function of several variables. Partial derivatives.	1, Ch. 8	1	2	2	4
3	Tangent planes and normal lines. Total differential. Linear approximation.	1, Ch. 8	1	2	2	4
4	Derivatives of composite functions. Implicit differentiation. Higher–order partial derivatives. Equality of mixed partials.	1, Ch. 8	1	2	2	4
5	Directional derivatives and gradients.	1, Ch. 8	1	2	2	4
6	Maximum and minimum of a function of several variables. Conditional maxima and minima.	1, Ch. 8	1	2	2	4
7	Double integrals. Basic properties. Double integral in polar coordinates.	1, Ch. 14	1	2	2	4
8	Geometrical and physical applications of double integrals.	1, Ch. 14				

9	Triple integrals. Change of variables in triple integrals. Cylindrical coordinates. Spherical coordinates.	1, Ch. 14	1	2	2	4
10	Geometrical and physical applications of triple integrals.	1, Ch. 14	1	2	2	4
11	Line integrals. Evaluating line integrals.	1, Ch. 15	1	2	2	4
12	Conditions for a line integral being independent of the path of integration. Green's formula.	1, Ch. 15	1	2	2	4
13	Surface integrals. Evaluating surface integrals.	1, Ch. 15	1	2	2	4
14	Stoke's formula. Ostrogradsky's formula.	1, Ch.15	1	2	2	4
15	The Hamiltonian operator and certain applications of it.	1, Ch. 15	1	2	2	4
	Total hours		**15**	**30**	**30**	**60**

7. Student performance evaluation system for the course

Period	Assignments	Number of points	Total
1st attestation	**Class work:**	**40**	100
	Regular attendance\Active participation	10	
	Quiz # 1	15	
	Quiz # 2	15	
	Student Independent Study:	**30**	
	Individual Home Work # 1	10	
	Individual Home Work # 2	10	
	Individual Home Work # 3	10	
	Mid term	**30**	
2nd attestation	**Class work:**	**40**	100
	Regular attendance\Active participation	10	
	Quiz # 3	15	
	Quiz # 4	15	
	Student Independent Study:	**30**	
	Individual Home Work # 4	10	
	Individual Home Work # 5	10	
	Individual Home Work # 6	10	
	End of term	**30**	
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	
F	0	0-49	Fail

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.