FACULTY OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM

I affirm:
Dean:

MA102

HIGHER MATHEMATICS PART II (CALCULUS)

Adopted prot. No. 11 of 11.11.2011
Teachers

Updated prot. No. 6 from 27.11.2018 Mr.
Assoc. Dr. P. Georgieva

ABSTRACT

In the course of Higher Mathematics Part II (Calculus), topics of differential and integral calculus of a function of one real variable are included and basic concepts of the theory of numerical sets and the theory of series of real numbers are considered.

Differentiation and integration of a function of one real variable are studied in depth, with special attention given to their applications.

The course also includes classes in a computer room with the aim of acquiring basic knowledge and skills for solving tasks on the topics in the Matlab programming environment.

MAIN OBJECTIVES AND LEARNING OUTCOMES

The main goal of the course in Higher Mathematics Part II is to form knowledge and skills for applying theoretical concepts (definitions and theorems) to solve both analytical and practical tasks.

At the end of his studies in Higher Mathematics Part II, the student must:

- has knowledge of the basic concepts (infinitely small and infinitely large quantity, limit of a numerical series, limit of a function, derivative of a function, indefinite integral, definite integral) and their properties;
- is able to apply the basic concepts and their properties for calculating derivatives and their applications, for calculating indefinite and definite integrals and their applications;
- is able to model practical problems in which the basic concepts of the differential and integral calculus of a function of a real variable are used;
- can use the Matlab programming environment to solve problems from the areas included in the course.

PREREQUISITES

The discipline Higher Mathematics Part II is basic for majors and requires prior study of the material in the disciplines: Higher Mathematics Part I, as well as knowledge of mathematics from the middle course of study.

Another important prerequisite for the successful achievement of the course objectives is the availability of textbooks, study aids, software-equipped computer rooms.

FORM OF EDUCATION

The forms of education are full-time and part-time.

STATUTE AND STRUCTURE

specialty status		Loans	regular training			distance learning		
			l	with u	common	l	with u	common
ICN	Mandatory	7	30	40	70	20	15	35
KST	Mandatory	7	30	40	70	20	15	35
KEVEI	Mandatory	7	30	40	70	20	15	35
SI	Mandatory	7	30	40	70	20	15	35
PIM	Mandatory	7	30	40	70	20	15	35
ESEO	Mandatory	7	30	10	70	20	15	35
PIUD	Mandatory	7	30	10	70	20	15	35
SIIT	Mandatory	7	30	10	70	20	15	35
EE	Mandatory	7	30	10	70	20	15	35

CONTENTS

A. LECTURES

B. SEMINAR EXERCISES

Topic 1. Number lines. Convergent number lines. Basic limits. Nepper constant.

Topic 2. Limit of a function. Left and right border. Continuity of a function. Bisection method for finding roots of non-linear equations. Asymptotes. Calculating limits of functions in the Matlab programming environment.

Topic 3. Methods of differentiation of functions.

Derivatives of elementary functions.

Derivatives of complex functions.

Logarithmic derivatives.

Higher order derivatives.

Calculating derivatives of functions in the Matlab programming environment.

Topic 4. Applications of the differential calculus.

Tangent to the graph. Angular coefficient.

Speed, acceleration.

Rates of change of quantities in engineering, natural and other sciences.

Differential of a function and linear approximation of a function value.

Development of a function in Taylor series and Maclauren series.

Newton's method for finding roots of non-linear equations.

Topic 5. Construction of graphs of functions of one real variable.

Monotony and extremes.

Convexity of the graph. Inflection points.

Construction of graphs.

Solving problems for the study of a function of one real variable and persistence of the graph in the Matlab programming environment.

Topic 6. Definite integral. Basic integration methods.

Direct integration.

Integration by substitution.

Integration by parts.

Integration by decomposition into a sum of elementary fractions.

Calculating integrals in the Matlab programming environment.

Topic 7. Applications of integral calculus.

Face of a plane figure.

Arc length.

Body volume.

Volume of a rotating body.

Work.

Average value of a function.

Moments.

Weight Center.

Other applications of the integral calculus.

Topic 8. Improper integrals.

C. COURSEWORK

Each student receives an individual assignment consisting of two modules:

1. tasks that must be solved independently by applying the studied theoretical material;
2. practical tasks to be implemented in the Matlab programming environment.

PLANNED LEARNING ACTIVITIES AND LEARNING METHODS

1. Students are provided with full information on the content of the course programme, as well as assessment requirements and the syllabus.
2. In the course of study, the conduct of two control works is foreseen.
3. Completing the course work, as well as successful preparation, requires classroom work, independent work during the semester and personal contact with the professors.
4. The electronic materials that are provided to the learners support the learning process and expand the possibilities of the teachers in carrying out in-depth training.

EVALUATION METHODS AND CRITERIA

The final assessment in Higher Mathematics Part II is complex, it consists of obtaining points from various activities, with the maximum number of points being 100.

The activities from which the assessment is formed are:

1. Audit employment up to 34 points

1.1 Current control of theoretical material up to 10 points
- a. attending lectures up to 5 points
- b. control works up to 5 points

1.2 Current control of seminar exercises up to 20 points
- a. attending seminar exercises as scheduled up to 4 points
- b. control works up to 12 points
- c. e-tasks up to 4 points

2. Extracurricular employment (coursework, essay, report, etc.)
up to 12 points

3. Exam procedure up to 54 points
   a. tasks up to 30 points
   b. theory up to 24 points

Remarks

1. If the student receives more than 36 points from item 1 and item 2, he has the right to a preliminary examination procedure (EXEMPTION).

2. If the student receives less than 14 points under item 1, he is not allowed to take the exam.

II. Grading scale

- from 36 to 50 points - average 3
- from 51 to 65 points - good 4
- from 66 to 80 points - very good 5
- from 81 to 100 points - excellent 6.

RECOMMENDED LITERATURE

1. Georgieva P. V., Differential and integral calculus, 2017
2. Georgieva P. V., Differential and integral calculus, 2015
3. Georgieva P., E. Nikolova, Formulas in higher mathematics, 2018
4. Ilin, Sadovnichi, Sendov, MATHEMATICAL ANALYSIS 1
5. Marinov, MATHEMATICAL ANALYSIS (parts 1 and 2)
6. Dimitrova K., P. Pascalev, Methodical guide for solving problems in higher mathematics part 1, Archimedes, 2006
7. Dimitrova K., P. Pascalev, Methodical guide for solving problems in higher mathematics part 2, Archimedes, 2012
8. Padevska St., Hristova M., Dimitrov M., Velev G., Higher mathematics in examples and problems, UNSS , 2010
9. Stewart J., Calculus, Brooks Cole, 2012