

# Syllabus

## 1. Course Description

### a. Title of a Course

*Computer Mathematics: Supplementary Chapters*

### b. Pre-requisites

This course is based on

- knowledge of main mathematical concepts and methods in discrete mathematics, linear algebra and real analysis;
- the material presented in basic computer programming and algorithm and data structure courses.

### c. Course Type (compulsory, elective, optional)

*Elective*

### d. Abstract

Supplementary Chapters of computer mathematics is a course for the second year students studying at MIEM NRU HSE specializing in Computer security. This course is an introduction to the methods of mathematical modelling using modern features of specialized software systems. The Wolfram Mathematica is used as a main tool of mathematical modelling in this course. The course focuses on the study of numerical and symbolic mathematical calculations, as well as on the study of the basic principles of programming in the Wolfram Mathematica system. The emphasis of the course is more on solving a variety of different problems rather than on the rigorous and theoretical study of general methods of mathematical modelling. The problems from different areas of mathematics are covered in the course, including elementary math, mathematical analysis, discrete mathematics, linear algebra and probability theory. The mathematical modelling of physical processes is also slightly covered in the course.

## 2. Learning Objectives

The objectives of the course are to study and practical mastering of modern computer technologies for carrying out applied mathematical research.

## 3. Learning Outcomes

- Student must know the main mathematical software and specialized packages of programs designed to solve applied mathematical problems, basic computer technologies for mathematical research and criterias for evaluating the effectiveness of using various algorithms, methods and computer technologies.
- Student must know how to choose software tools and professionally use computers for solution of applied problems.
- Student must own the skills of finding adequate and effective ways of solving mathematical problems with using computer technology.

## 4. Course Plan

1. Introduction in Mathematical Software. What is difference between symbolic and numerical calculation? (2 h. lecture, 2 h. practical)
2. Introduction in Wolfram Language. (6 h. lecture, 6 h. practical)
3. Basic mathematical problems solving by using Wolfram Mathematica. (6 h. lecture, 8 h. practical)
4. Advanced using Wolfram Mathematica. (6 h. lecture, 8 h. practical)
5. The study of applied mathematics models with the computer technologies. (4 h. lecture, 8 h. practical)

## 5. Reading List

### a. Required

1. Wolfram Language & System Documentation Center, <http://reference.wolfram.com/language/>
2. S. Wolfram. An Elementary Introduction to the Wolfram Language. Wolfram Media, Inc., 2017, <https://www.wolfram.com/language/elementary-introduction/2nd-ed/>.
3. Р. Л. Грэхем, Д. Э. Кнут, О. Паташник; Пер. с англ. и ред. И. В. Красикова. – 2-е изд. – М.; СПб.; Киев: Вильямс, 2010. – 782 с.

### b. Optional

1. H. Li, Y. Sui, S. Miu, T. Han Mathematica Basic Training Course. National Defence Industry Press, 2016
2. M. Mureşan. Introduction to Mathematica with Applications. Springer, 2017

## 6. Grading System

The final grade  $O_{final}$  for the course is calculated by following formula

$$O_{final} = 0.6 O_{current} + 0.4 O_{exam},$$

where  $O_{exam}$  is the score for the exam and  $O_{current}$  is the score for work in the semester, which is calculated as

$$O_{current} = 0,4 O_{class} + 0,3 O_{home} + 0,3 O_{control},$$

$O_{class}$  is the score for work on practical exercises,  $O_{home}$  is the score for the homework and  $O_{control}$  is the score for the control work.

## 7. Guidelines for Knowledge Assessment

The student must demonstrate the ability to solve set tasks using Wolfram Mathematica software. He must be able to evaluate and correctly interpret the results he obtained, and also understand the basic principles of the algorithms on which the functions of Wolfram Mathematica are based.

8. Methods of Instruction

*Lectures (24 h) and practical exercises (32 h)*

9. Special Equipment and Software Support (if required)

*Wolfram Mathematica 11*