# Course description



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|---|---|---|---|---|---|---|
| **Department/Unit /** | KMA / MMM2 | | | **Academic Year** | 2023/2024 |
| **Title** | Mathematical Modelling Methods 2 | | | **Type of completion** | Exam |
| **Accredited/Credits** | Yes, 5 Cred. | | | **Type of completion** | Combined |
| **Number of hours** | Lecture 3 [Hours/Week] Tutorial 2 [Hours/Week] | | | | |
| **Occ/max** | Status A | Status B | Status C | **Course credit prior to** | YES |
| **Summer semester** | 0 / - | 0 / - | 0 / - | **Counted into average** | YES |
| **Winter semester** | 0 / - | 0 / - | 0 / - | **Min. (B+C) students** | 1 |
| **Timetable** | Yes | | | **Repeated registration** | NO |
| **Language of instruction** | | | | **Semester taught** | Summer semester |
| **Optional course** | Yes | | | **Internship duration** | 0 |
| **Evaluation scale** | 1\|2\|3\|4 | | | **Ev. sc. – cred.** | S\|N |
| **No. of hours of on-premise** | | | | | |
| **Auto acc. of credit** | No | | | | |
| **Periodicity** | K | | | | |
| **Substituted course** | KMT/MMM2 | | | | |
| **Preclusive courses** | N/A | | | | |
| **Prerequisite courses** | N/A | | | | |
| **Informally recommended courses** | N/A | | | | |
| **Courses depending on this Course** | N/A | | | | |

## Course objectives:

The aim of this course is to provide the students basic mathematical tools for the description and modeling of laws and quantities of nature and to learn them to solve basic problems from application fields. Last but not least, we try to provide the future teachers of mathematics, physics, biology, chemistry, geography the necessary mathematical background for a modern analysis of problems from the above stated areas.

## Requirements on student

Tests during the term;
written and oral exam

## Content

1. Sequence as a model of a discrete system - recurrence and difference equation. Sequence as a mathematical object - algebra and properties, convergence and divergence. Sequence of partial sums - infinite sums. Sequences in finance, biology and social sciences.
2. Function as a model of a continuous system - basic functions, graphs, diagrams. Function operations, continuity, composed function. Local properties. Function as a tool of description of natural and economic quantities and dependences.
3. Fundaments of differential calculus - difference, differential, derivative. Methods of differentiation. Modeling of changes in natural sciences, economy and social sciences.
4. Methods of differential calculus - basic optimization, formulation of basic natural laws. Primitive function and methods of solving simple differential equations. Potential.
5. Definite integral as a model of a balance principle. Properties and methods of calculations. Integral sum - geometric and physical interpretation.
6. Local polynomial approximation of a function - Taylor formula, derivatives and differentials of higher orders, simple approximate calculations.

## Fields of study

## Guarantors and lecturers

- **Guarantors:** Doc. Ing. Gabriela Holubová, Ph.D. (100%)

## Literature

- **Recommended:** Gillman, Leonard; McDowell, Robert H. *Matematická analýza*. 1. vyd. Praha : SNTL, 1980.
- **Recommended:** Drábek, Pavel; Míka, Stanislav. *Matematická analýza I*. 1. vyd. Plzeň : Západočeská univerzita, 1995. ISBN 80-7082-217-1.
- **Recommended:** Míka, S. *Speciální učební texty*. Systém TRIAL, KMA ZCU.

## Time requirements

### All forms of study

| Activities | Time requirements for activity [h] |
|---|---|
| Contact hours | 65 |
| Preparation for comprehensive test (10-40) | 25 |
| Preparation for formative assessments (2-20) | 20 |
| Preparation for an examination (30-60) | 30 |
| **Total:** | **140** |

## assessment methods

### Knowledge - knowledge achieved by taking this course are verified by the following means:

Combined exam

Test

## prerequisite

### Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

There is no prerequisite for this course. Students should be familiar with a high school algebra and trigonometry.

## teaching methods

### Knowledge - the following training methods are used to achieve the required knowledge:

Lecture

Practicum

Multimedia supported teaching

Task-based study method

## learning outcomes

### Knowledge - knowledge resulting from the course:

The student is able to understand and to describe the basic laws in nature sciences by mathematical tools.

## Course is included in study programmes:

| Study Programme | Type of | Form of | Branch | Stage | St. plan v. | Year | Block | Status | R.year | R. |
|---|---|---|---|---|---|---|---|---|---|---|
| Natural Science Studies | Bachelor | Full-time | Biology in Education | 1 | 15 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Biology in Education | 1 | 16 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |

| Study Programme | Type of | Form of | Branch | Stage | St. plan v. | Year | Block | Status | R.year | R. |
|---|---|---|---|---|---|---|---|---|---|---|
| Natural Science Studies | Bachelor | Full-time | Biology in Education | 1 | 18 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Biology in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Biology in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Geography in Education | 1 | 18 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Geography in Education | 1 | 15 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Geography in Education | 1 | 16 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Geography in Education | 1 | 1 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Geography in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Geography in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Chemistry in Education | 1 | 14 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Chemistry in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Chemistry in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Chemistry in Education | 1 | 16 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Chemistry in Education | 1 | 18 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Information Technologies in Education | 1 | 18 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Information Technologies in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Information Technologies in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Information Technologies in Education | 1 | 15 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Information Technologies in Education | 1 | 16 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Physics in Education | 1 | 15 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Physics in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Physics in Education | 1 | 16 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Physics in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Studies in Mathematics | 1 | 17 | 2023 | Povinné předměty | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Studies in Mathematics | 1 | 19 | 2023 | Povinné předměty | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Studies in Mathematics | 1 | 18 | 2023 | Povinné předměty | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Technology and Design in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Technology and Design in Education | 1 | 18 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Technology and Design in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Natural Science Studies | Bachelor | Full-time | Technology and Design in Education | 1 | 16 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |

| Study Programme | Type of | Form of | Branch | Stage | St. plan v. | Year | Block | Status | R.year | R. |
|---|---|---|---|---|---|---|---|---|---|---|
| Physical Education and Sport | Bachelor | Full-time | Physical Education in Education | 1 | 17 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Physical Education and Sport | Bachelor | Full-time | Physical Education in Education | 1 | 18 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Physical Education and Sport | Bachelor | Full-time | Physical Education in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Specialization in Pedagogy | Bachelor | Full-time | English Language in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |
| Specialization in Pedagogy | Bachelor | Full-time | Music in Education | 1 | 19 | 2023 | Matematika - vedlejší sloup | A | 1 | LS |