# General Informations:

**Curriculum:** Architecture Bsc/O

**Name of Course: Mathematics 2**

**Course Code:** EPE076AN

**Semester:** 2023/24/2

**Number of Credits:** 4

**Allotment of Hours per Week:** 1/2/0

**Evaluation:** examination grade

**Prerequisites: -**

Course director: Péter Szabó, assistant lecturer

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Instructors: Péter Szabó, assistant lecturer

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## General Course Description

This lecture- and practical-based course aims to give architect students a solid background in the theory of mathematical calculus, enabling them to interpret and understand architectural sciences. During the course, students learn to plot the graph of different functions, apply differentiation and integration techniques, solve geometric optimization problems, calculate the area of shapes bounded by curves and calculate the volume of simple solids in the 3D space. They further deepen their basic theoretical knowledge in the field of architecture through solving practical exercises.

## Learning Outcomes

The lectures give some elements of important mathematical techniques that are used in an architect’s practice. Upon completion of this course, the student should be able to: interpret, and put into practice

1. Plotting the graph of elementary and transformed functions
2. Finding the derivative of functions and sketching the graph
3. Solving optimization problems by finding minima and maxima of functions
4. Finding the integral of a function and calculating the area under the function curve
5. Calculating the volume of simple solids using different methods
6. Understanding the geometric meaning of directional derivative and gradient of 2D surfaces

## Subject content

Lecture:

* Plotting, transforming and describing simple functions
* Limit of numeric sequences and real-valued functions, continuity
* Differentiating functions, application in geometric optimization problems
* Definite and indefinite integral, application to calculate area, volume and center of mass
* Multivariate functions, partial derivatives, gradient, double integral

Practice: the weekly practice classes closely follow the topics of the lecture with corresponding exercises

**Examination and evaluation system**

*In all cases. Annex 5 of the Statutes of the University of Pécs, the* ***Code of Studies and Examinations (CSE)******of the University of Pécs*** *shall prevail*

[*https://international.pte.hu/sites/international.pte.hu/files/doc/TVSZ%202022\_06\_23\_ENG.pdf*](https://international.pte.hu/sites/international.pte.hu/files/doc/TVSZ%202022_06_23_ENG.pdf)

**Attendance**

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance: attendance sheet

**Assessment**

Two midterm tests in the study period, written exam in the exam-period. One-time retake for both tests. Proposed final grade.

**Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam**

|  |  |  |
| --- | --- | --- |
| **Type** | **Assessment** | **Ratio in the mid-term performance** |
| *Test 1* | *max 45 points* | *50%* |
| *Test 2* | *max 45 points* | *50%* |

**Requirements for the end-of-semester signature**

Grading will follow the course structure with the following details:

The two midterm tests account for 50-50% in the evaluation of the mid-term performance. At least 40% midterm performance is required for the end-of-semester signature. Only students with signature can get a final grade.

***Re-takes for the end-of-semester signature*** *(PTE CSE 50§(2))*Each test can be repeated/improved once in the first two weeks of the examination period.The score of the retake will overwrite the score of the corresponding test.

***Exam and proposed final grade***

Only students with signature (i.e., at least 40% mid-term performance) can get a final grade. Students with signature get a proposed final grade based on their mid-term performance (see the calculation of the grade below). Students, who accept their proposed grade in Neptun ES do not have to take the exam!

Students, who do not accept the proposed grade can get a final grade by registering for an exam in Neptun ES.

**Type of examination**: written

The exam is successful if the result is minimum 40%.

**Calculation of the final grade (PTE CSE 47§ (3))**

The mid-term performance and the performance at the final exam account for 50-50% in the calculation of the final grade.

**Calculation of the final grade based on aggregate performance in percentage**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Grade: | 5 | 4 | 3 | 2 | 1 |
|  | A, excellent | B, good | C, satisfactory | D, pass | F, fail |
| Performance in %: | 85%-100% | 70%-84% | 55%-69% | 40%-54% | 0-39% |

## Readings and Reference Materials

**Required:**

[1.] Enikő Dinnyés and Ferenc Kárpáti: Mathematics for Architects II – Analysis of functions. Digital lecture notes. PTE MIK Mérnöki Matematika Tanszék, Pécs

## Methodology

The course is structured in a way that helps the students internalise the basics of mathematical calculus and its various applications in engineering, which, in turn, can be used to solve concrete planning and modelling tasks. We put great emphasis on improving individual problem-solving skills by integrating different mathematical methods into an interconnected system. At first, each topic is presented from a theoretical point of view and then unfolded through a wide range of engineering applications. The presentations give an introduction to important mathematical techniques of exercise solving and the basic theory of calculus. Equal emphasis is given to learning new mathematics and to learning how to construct and formulate correct mathematical arguments.

1. In lectures: the theoretical background of the topic is presented to the students and illustrated with examples

2. In practices: the students individually solve different exercises corresponding to the applications of the theory, then, the solutions are discussed together and further explained by the lecturer

3. On-demand consultations in person or in small groups

## Students with Special Needs

Students with a disability and needs to request special accommodations, please, notify the Deans Office. Proper documentation of disability will be required. All attempts to provide an equal learning environment for all students will be made.

*Detailed requirements and schedule of the Course*

## Schedule

Study period: 14 weeks (5 February - 11 May 2024)

Test 1: 20 March 2024 (7th week, during practice class)

Test 2: 8 May 2024 (14th week, during practice class)

Retake of Tests: in the 1st week of the exam period (13-17 May 2024)

Exams: in the exam period (13 May - 14 June 2024)

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| Lecture  |
| week | **Topic** | **Compulsory reading; page number****(from … to …)** | **Required tasks (assignments, tests, etc.)** | **Completion date, due date** |
| 1. | Graph of elementary functions (power, root, exponential, logarithmic, trigonometric, cyclometric), linear transformation of functions | [1], 3-4, 13-17 | - | 07.02.2024 |
| 3. | Limit of numeric sequences and real-valued functions, continuity and other properties of functions | [1], 5-12, 18-19 | - | 21.02.2024 |
| 5. | Differential quotient, derivatives of elementary functions, differentiation rules, applications (equation of tangent line, monotonicity, extrema, convexity, inflexion point) | [1], 20-29 | - | 06.03.2024 |
| 7. | Integral approximating sum, definite and indefinite integral, primitive function, integration techniques, fundamental theorem of calculus | [1], 30-36 | - | 20.03.2024 |
| 9. | Applications of integral: area under the function curve, area between function curves, coordinates of center of mass, Cavalieri-principle, volume of solid of revolution | [1], 36-42 | - | 03.04.2024 |
| 11. | Bivariate functions, partial and directional derivatives, gradient vector, geometric interpretation; Double integral, calculation on normal domain, application to calculating the volume of simple solids | [1], 43-54 | - | 17.04.2024 |
| 13. | International Workers’ Day (no lecture) | - | - | 01.05.2024 |

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| Practice |
| week | **Topic** | **Compulsory reading; page number****(from … to …)** | **Required tasks (assignments, tests, etc.)** | **Completion date, due date** |
| 1. | Graph of elementary functions (power, root, exponential, logarithmic, trigonometric, cyclometric), linear transformation of functions | [1], 3-4, 13-17 | - | 07.02.2024 |
| 2. | Limit of numeric sequences and real-valued functions, composition of functions | [1], 5-12, 18 | - | 14.02.2024 |
| 3. | Continuity and other properties of functions | [1], 18-19 | - | 21.02.2024 |
| 4. | Differential quotient, derivatives of elementary functions, differentiation rules  | [1], 20-24 | - | 28.02.2024 |
| 5. | Applications of differentiation: equation of tangent line, monotonicity, extrema, convexity, inflexion point, sketching the graph of function, optimization problems | [1], 25-29 | - | 06.03.2024 |
| 6. | Indefinite integral (antiderivative), integration techniques | [1], 31, 34-36 | - | 13.03.2024 |
| 7. | Test 1 | - | Test 1 | 20.03.2024 |
| 8. | Integral approximating sum, definite integral, integral function, fundamental theorem of calculus, applications of integral I (area under the function curve, area between function curves) | [1], 30-34 | - | 27.03.2024 |
| 9. | Applications of integral II: coordinates of center of mass, volume of solid of revolution, Cavalieri-principle | [1], 36-42 | - | 03.04.2024 |
| 10. | Bivariate functions, domain, contour lines, partial derivatives | [1], 43-46 | - | 10.04.2024 |
| 11. | Directional derivative and gradient vector of bivariate functions, geometric interpretation | [1], 46-48 | - | 17.04.2024 |
| 12. | Integration of bivariate functions (double integral), calculation on normal domain, application to calculating volume of simple solids | [1], 48-54 | - | 24.04.2024 |
| 13. | International Workers’ Day (no lecture) | - | - | 01.05.2024 |
| 14. | Test 2 | - | Test 2 | 08.05.2024 |



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 course director

Pécs, 25.01.2024