# COURSE SYLLABUS AND COURSE REQUIREMENTS
# ACADEMIC YEAR 2023-2024 SEMESTER SPRING

| | |
|---|---|
| *Course title* | *Engineering Mathematics 2.* |
| *Course Code* | MSB294, MSB594, IVB292 |
| *Hours/Week: le/pr/lab* | 2/2/0 |
| *Credits* | 4 |
| *Degree Programme* | Civil, Computer Science, Electrical Engineering BSc |
| *Study Mode* | Full-time |
| *Requirements* | Exam |
| *Teaching Period* | Spring |
| *Prerequisites* | Engineering Mathematics 1. |
| *Department(s)* | Department of Engineering Mathematics |
| *Course Director* | Ákos PILGERMÁJER |
| *Teaching Staff* | Ákos PILGERMÁJER, András KASZÁS |

## COURSE DESCRIPTION

Lectures give introduction to the basic theory of calculus and important mathematical techniques of problem solving. Equal emphasis is given to learning new mathematics and to learning how to construct and write down correct mathematical arguments. Upon completion of this course, the student should be able to: interpret, and put into practice

a. applications of derivatives
b. integral calculus in one variable and its applications to engineering problems
c. basics of differential and integral calculus in two variables
d. ordinary differential equations of special kinds

## SYLLABUS

### 1. GOALS AND OBJECTIVES

The course has lectures and laboratory sessions. The instructors' aim to give civil, computer science and electrical engineer students the necessary mathematical background through intuitive and visual presentations during lectures supported by examples of the corresponding concepts. These are further investigated in more detail during laboratory classes. Firstly, by instructed problem solution then by independent student work, if possible, using the Möbius teaching and assessment system. Students learn the basics of mathematics enabling them to interpret and understand engineering sciences and through solving elementary tasks they deepen their basic theoretical knowledge in the field of engineering. The practical sessions are designed to complement the requirements of different specializations.

### 2. COURSE CONTENT

| | TOPICS |
|---|---|
| **LECTURE** | 1. Applications of derivatives<br>2. Integral calculus in one variable and its applications<br>3. Differential and integral calculus in two variables<br>4. Ordinary differential equations of special kinds |
| **PRACTICE** | |
| **LABORATORY PRACTICE** | 1. Applications of derivatives<br>2. Integral calculus in one variable and its applications<br>3. Differential and integral calculus in two variables<br>4. Ordinary differential equations of special kinds |

## DETAILED SYLLABUS AND COURSE SCHEDULE

*ACADEMIC HOLIDAYS INCLUDED*

***LECTURE (Classes: Wednesdays 9:30-11:00 in A-019)***

| *week* | **Topic** | **Compulsory reading; page number (from … to …)** | **Required tasks (assignments, tests, etc.)** | **Completion date, due date** |
|---|---|---|---|---|
| *1.* | *Introduction to the course, discussion of the syllabus. L'Hôpital's rule, linear approximation, higher order approximation: Taylor polynomial, remainder term, order of osculation* | [1] 221-231, 292-299, 805-822 | | |
| *2.* | *Applications of differential calculus to the study of properties of functions; function discussion* | [1] 244-278 | | |
| *3.* | *Solving applied optimization problems. Antiderivatives, basic integration formulae* | [1] 278-292, 307-318, 553-561 | | |
| *4.* | *Integration by parts, change of variable* | [1] 561-570, 368-376 | | Homework 1 |
| *5.* | *Integration of rational functions by partial fraction decomposition, integration of rational expressions containing trigonometric functions* | [1] 570-593 | | *Midterm 1 (8 March 2024)* |
| *6.* | *Definite integral, Riemann-sum, numerical integration, Newton-Leibniz theorem, applications of the integral: area under the graph of a function* | [1] 325-368 | | |
| *7.* | *Applications of the integral: area between curves, length of a curve, area of the surface and volume of the solid of revolution* | [1] 376-387, 396-461 | | |
| *8.* | *Improper integrals* | [1] 619-633 | | |
| *9.* | *The function of two variables, partial derivatives, directional derivatives, gradient vector* | [1] 965-1005, 1005-1015 | | |
| *10.* | *Multiple integrals and their applications* | [1] 1067-1111 | | |
| *11.* | *First-order separable and linear differential equations, Lagrange's method (variation of the parameters)* | [1] 642-650, 1452-1474 | | Homework 2 |
| *12.* | *Second-order linear differential equations with constant coefficients: three cases, resonance, undetermined coefficients method* | [1] 1493-1504 | | *Midterm 2 (26 April 2024)* |
| *13.* | ***On Wednesday: Labour's Day (National Holiday)*** | | | |
| *14.* | *Consultation for the exam, retakes* | | | |

***LABORATORY PRACTICE***
***(Classes: Monday 11:15-12:45, Wednesday 11:15-12:45, Wednesday 15:00-16:30)***
***M: MÖBIUS ASSESSMENT***

| *week* | **Topic** | **Compulsory reading; page number (from … to …)** | **Required tasks (assignments, tests, etc.)** | **Completion date, due date** |
|---|---|---|---|---|
| *1.* | *L'Hôpital's rule, linear approximation, differentials, higher order approximation with Taylor polynomial, remainder term, order of osculation* | [1] 221-231, 292-299, 805-822 | M: Application of derivatives 1 | |
| *2.* | *Applications of differential calculus to the study of properties of functions; function sketch through discussion* | [1] 244-278 | M: Application of derivatives 2 | |
| *3.* | *Solving applied optimization problems. Antiderivatives, basic integration formulae* | [1] 278-292, 307-318, 553-561 | M: Application of derivatives 2, Antiderivatives 1 | |
| *4.* | *Integration by parts, change of variable* | [1] 561-570, 368-376 | M: Antiderivatives 2 | Homework 1 |
| *5.* | *Integration of rational functions by partial fraction decomposition, integration of rational expressions containing trigonometric functions* | [1] 570-593 | M: Antiderivatives 3 | *Midterm 1 (8 March 2024)* |
| *6.* | *Definite integral, Riemann-sum, Newton-Leibniz theorem (Fundamental Theorem of Calculus), area under the graph of a function* | [1] 325-368 | M: Definite integral 1 | |
| *7.* | *Applications of the integral: area between curves, length of a curve, moments and centres of mass, area of the surface and volume of the solid of revolution* | [1] 376-387, 396-461 | M: Definite integral 2 | |
| *8.* | *Improper integrals* | [1] 619-633 | | |
| *9.* | ***Easter Monday (National Holiday), Wednesday lessons will be held.*** *The function of two variables, partial derivatives, directional derivatives, gradient vector* | [1] 965-1005, 1005-1015 | M: Function of two variables 1 | |
| *10.* | *Multiple integrals and their applications* | [1] 1067-1111 | M: Function of two variables 2 | |
| *11.* | *First-order separable and linear differential equations* | [1] 642-650, 1452-1474 | M: Differential equation 1 | Homework 2 |
| *12.* | *Second-order linear differential equations with constant coefficients: three cases, resonance, undetermined coefficients method* | [1] 1493-1504 | M: Differential equation 2 | *Midterm 2 (26 April 2024)* |
| *13.* | ***Wednesday: Labour's Day (National Holiday), Monday lesson will be held.*** | | | |
| *14.* | *Consultation for exam, retakes* | | | |

**ATTENDANCE**

***Method for monitoring attendance***

Attendance sheet/ online test/ other valid means of checking attendance. Making up any absence is not possible according to the current state of science. No need for verification of absence, but keep it under the regulation limit (30 % of total contact hours (lectures and laboratory classes)).

**ASSESSMENT**

## *Course-unit with final examination*

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

| Type | Assessment | *Weighting as a proportion of the pre-requisite for taking the exam* |
|---|---|---|
| **Homeworks (Möbius platform)** | *test points* | *10 %* |
| **Midterm tests (>= 40 %)** | *test points* | *90 %* |

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

***In general:***

- Midterm tests and homeworks are compulsory. Missing both midterm tests terminates in failure of the course!
- At most one midterm test can be made up due to serious causes which must be written in advance to the lecturer in a Teams message.
- Homeworks can be handed in continuously during their availability, but no delays are permitted.

***In particular:***

- Successful midterm tests (>= 40 % for each)

AND

- submitted homeworks

AND

- successful ***mid-term performance***:

90%*(MTT1%+MTT2%)/2+10%*(HW1%+HW2%)/2 >= 40%,

where MTT[12]%: midterm test [12] %, HW[12]%: homework[12] %

***Re-takes for the end-of-semester signature***

Make up of at most one unwritten or retake (only once due to regulations) of the unsuccessful midterm will be held on the 1st week of the exam period.

***Type of examination*** *(written, oral): written (plus oral if grade 5 is the student's aim)*

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

***Calculation of the final grade***

1. **Offered grade** (*without an exam*): if the student's mid-term performance is better than 55 %, then I offer a grade to her/him based upon her/his performance between 3 and 4. This offered grade will be registered into the Neptun system and must be accepted or denied during the exam period. Otherwise, it will be unvalidated.
2. **Final grade** (*with an exam* taken in the exam period): If the student earned the end of semester signature but did not get or accepted the offered grade, *must take an exam* in the exam period for which (s)he registers in Neptun in advance as usual.

The mid-term performance accounts for ***50*** %, the performance at the exam accounts for ***50*** % in the calculation of the final grade.

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

| Course grade | Performance in % |
|---|---|
| excellent (5) | 85 % … |
| good (4) | 70 % ... 85 % |
| satisfactory (3) | 55 % ... 70 % |
| pass (2) | 40 % ... 55 % |
| fail (1) | below 40 % |

The lower limit given at each grade belongs to that grade.

## 3. SPECIFIED LITERATURE

**COMPULSORY READING AND AVAILABILITY**

[1] George B. Thomas, Jr.: Thomas' Calculus, Eleventh, International Edition, Pearson Addison Wesley, 2006.

**RECOMMENDED LITERATURE AND AVAILABILITY**

[2] Additional course materials on Teams.