

I. Tantárgyleírás

1. Alapadatok

1.1 Tantárgy neve

Numerical Methods

1.2 Azonosító (tantárgykód)

BMEEOAFMB51

1.3 Tantárgy jellege

Kontaktórási tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Laboratóriumi gyakorlat	2

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Vizsga

1.6 Kreditszám

4

1.7 Tárgyfelelős

név	Dr Piroska Laky
beosztás	Egyetemi docens
email	laky.piroska@emk.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Általános- és Felsőgeodézia Tanszék

1.9 A tantárgy weblapja

<https://epito.bme.hu/BMEEOAFMB51>

<https://edu.epito.bme.hu/course/view.php?id=3562>

1.10 Az oktatás nyelve

angol

1.11 Tantárgy típusa

Kötelező az Építményinformatikai mérnök (MSc) szakon

1.12 Előkövetelmények

1.13 Tantárgyleírás érvényessége

2022. szeptember 1.

2. Célkitűzések és tanulási eredmények

2.1 Célkitűzések

The aim of the subject is for the students to learn and apply the possibilities of computer numerical solutions of engineering problems at a good skill level. The basic principles, advantages, disadvantages and applicability of the most relevant numerical techniques are presented during the laboratory exercises. Students can primarily learn about and apply mathematical procedures suitable for solving and visualizing technical problems using computers through civil engineering examples. Another goal of the course is to prepare students for later independent research.

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése utána a hallgató

A. Tudás

1. The student is familiar with the general principles, rules and procedures of mathematics, science and informatics in connection with the design and construction of civil engineering facilities,
2. Has the informatics knowledge necessary for the development of technical systems and process automation,
3. Has skill-level knowledge of a mathematical environment,
4. Can differentiate between errors in numerical calculations,
5. Knows methods for solving systems of linear and non-linear equations,
6. Is aware of the difference between interpolation and regression methods,
7. Has an overview of some optimization methods
8. Is informed about different numerical derivation and integration procedures
9. Knows some methods of solving ordinary differential equations

B. Képesség

1. Is able to apply the necessary natural science and IT principles in the design and construction of buildings,
2. Is able to skillfully use a mathematical environment to solve engineering problems
3. Is able to interpret the error messages that arise and correct the errors based on them
4. Is able to use the documentation effectively, find the necessary commands, interpret the algorithms and parameters used by the commands
5. Routinely creates graphs in a mathematical environment, parametrizes them in accordance with expectations,
6. Is able to choose the proper algorithm for the specific problem
7. Is able to fit an interpolation or regression curve/surface to measurement data
8. Is able to skillfully solve systems of linear or non-linear equations
9. Can determine the extreme values of a given function/curve/surface,
10. Is able to differentiate and integrate numerically when solving a given problem,
11. Is able to solve ordinary differential equations;

C. Attitűd

1. Open to the application of new IT tools, methods and procedures in his own specialization,
2. Receptive to simple and efficient program codes,
3. Attempts to write a well-documented script with comments understandable for others

D. Önállóság és felelősség

1. Independently performs the solution of the problem assigned as homework
2. Openly receives the well-founded critical comments, accepts the proposals and integrates them during the further work

2.3 Oktatási módszertan

Lectures and computer laboratory practices.

2.4 Részletes tárgyprogram

Week	Topics of lectures and/or exercise classes
1.	Introduction to a mathematical environment
2.	Introduction to numerical methods, calculation errors.
3.	Roots of nonlinear equations
4.	Systems of linear equations
5.	Solving nonlinear systems of equations
6.	Univariate interpolation, regression
7.	Bivariate regression, interpolation
8.	Midterm Test
9.	Numerical derivation, integration
10.	Unconstrained optimization
11.	Constrained optimization
12.	Ordinary Differential Equations I.(initial value problem)
13.	Ordinary Differential Equations II. (boundary value problem)
14.	Summary

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

a) Books and online materials

1. Matlab documentation - <https://www.mathworks.com/help/matlab/>
2. [Piroska Laky](#), [Bence Ambrus](#): Numerical methods for Civil Engineers, Lecture notes by [Piroska Laky](#)

(translated to English by [Bence Ambrus](#)), 228 pages (available in the educational framework)

3. Todd Young and Martin J. Mohlenkamp (2018): Introduction to Numerical Methods and Matlab Programming for Engineers, Ohio University, 172 oldal
(<http://www.ohiouniversityfaculty.com/youngt/IntNumMeth/book.pdf>)
4. Amos Gilat, Vish Subramaniam (2011): Numerical methods, An introduction with Applications Using MATLAB, John Wiley & Sons, ISBN 978-0-470-87374-8, 460 oldal

b) Presentations, descriptions, tasks available on the educational framework

2.6 Egyéb tudnivalók

The use of own laptops during labor practices is allowed if the used softwares are previously installed.

2.7 Konzultációs lehetőségek

Appointments: As specified on the department's website, or in consultation with the course instructors via e-mail

Jelen TAD az alábbi félévre érvényes:

2023/2024 semester II

II. Tárgykövetelmények

3. A tanulmányi teljesítmény ellenőrzése és értékelése

3.1 Általános szabályok

The assessment of the learning outcomes specified in clause 2.2 above and the evaluation of student performance occurs via a [midterm test](#), practice exercises and an exam at the end.

3.2 Teljesítményértékelési módszerek

Evaluation form	Abbreviation	Assessed learning outcomes
Practice exercises (Minor homeworks, formative assessment)	P	A.1-A.9; B.1-B.11; C.1-C.3; D.1-D.2
Midterm test (Summative assessment)	MT	A.1-A.6; B.1-B.8; C.1-C.3
Exam	E	A.1-A.9; B.1-B.11; C.1-C.3

A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Abbreviation	Score
P	30%
MT	30 %
E	40 %
Sum	100 %

The minimum requirement for the [midterm test](#) is 40 % (12 points from 30).

The minimum requirement for the exam is 50 % (20 points from 40).

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

The condition for obtaining the signature is that the student achieves at least 50% of the points that can be obtained during the semester (30 points out of 60) and that the [midterm test](#) (MT) is successful.

The midterm result that can be taken into account at the examination grade previously obtained from the subject can be accepted retroactively for 4 semester.

3.5 Érdemjegy megállapítása

Grade	Points (P)
excellent (5)	$86 \leq P$
good (4)	$73 \leq P < 86\%$
satisfactory (3)	$60 \leq P < 73\%$
passed (2)	$50 \leq P < 60\%$
failed (1)	$P < 50\%$

The final grade is calculated from the sum of the points obtained during the semester (60%) and the points obtained in the exam (40%).

3.6 Javítás és pótlás

1. The actual date of the retake can be found in the „Detailed course schedule” on the subject’s website.

The result of the last test will be the final result for the test.

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/semester
contact hours	$14 \times 2 = 28$
preparation for the courses	$14 \times 2 = 28$
practice exercises	$10 \times 1 = 10$
preparation for the tests	$1 \times 24 = 24$
preparation for exam	$1 \times 30 = 30$
Sum	120

3.8 A tárgykövetelmények érvényessége

2022. szeptember 1.

Jelen TAD az alábbi félévre érvényes:

2023/2024 semester II