

## COURSE SYLLABUS AND COURSE REQUIREMENTS

ACADEMIC YEAR ... SEMESTER ...

<i>Course title</i>	<b>NUMERICAL METHODS FOR CIVIL ENGINEERING</b>
<i>Course Code</i>	MSM007AN
<i>Hours/Week: le/pr/lab</i>	1/0/2
<i>Credits</i>	3
<i>Degree Programme</i>	Structural Engineer
<i>Study Mode</i>	computer supported
<i>Requirements</i>	written midterm exams
<i>Teaching Period</i>	1 semester
<i>Prerequisites</i>	Civil Engineer BSc
<i>Department(s)</i>	Department of Civil Engineering
<i>Course Director</i>	
<i>Teaching Staff</i>	Prof. Dr. Anikó Csébfalvi

## COURSE DESCRIPTION

A short description of the course (max. 10 sentences).

Neptun: [Instruction/Subjects/Subject Details/Basic data/Subject description](#)

... Numerical methods provide a way for the engineer to translate the language of mathematics and physics into information that may be used to make engineering decisions. Often, this translation is implemented so that calculations may be done by computers. The types of problems that you encounter as an engineer may involve a wide variety of mathematical phenomena, and hence it will benefit you to have an equally wide range of numerical methods with which to approach some of these problems. This course will provide you with an introduction to several of those numerical methods which you may then find opportunity to practice later in the curriculum.

The purpose of this course is to introduce students to a basic knowledge of numerical methods and learn its application for engineering problems. The selected topics are focusing for engineering problems and related computational methods.

## SYLLABUS

Neptun: [Instruction/Subjects/Subject Details/Syllabus](#)

### 1. GOALS AND OBJECTIVES

Goals, student learning outcome.

Neptun: [Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction](#)

... **Short description:**

This course contains 12 units (listed below) of selected topics of numerical methods. In order to complete this course, you will need to work through each selected unit and all of its assigned materials in the book **NUMERICAL METHODS WITH APPLICATIONS** (Authors: Autar K Kaw | Co-Author: Egwu E Kalu, Duc Nguyen) ([http://nm.mathforcollege.com/topics/textbook\\_index.html](http://nm.mathforcollege.com/topics/textbook_index.html)) given in the Readings and Reference Materials.

Please give time to these; they are the best way to test your knowledge and learn.

... **Methodology:**

The solution methods are applied and demonstrated with help of Wolfram Mathematica (© 2015 Wolfram. All rights reserved). Legal licensed version available in room A 117. Student version: <http://www.wolfram.com/solutions/education/students/>.

Textbooks are provided to help students to follow the teaching materials and understand the presented computational examples (see: at the end of the syllabus).

### 2. COURSE CONTENT

Neptun: [Instruction/Subjects/Subject Details/Syllabus/Subject content](#)

#### TOPICS

#### LECTURE

1. Define and identify special types of matrices.
2. Perform basic matrix operations.
3. Define and solve linear systems.

## LABORATORY PRACTICE

4. Define interpolation.
5. Define and use direct interpolation to approximate data and find derivatives.
6. Define and use Newton's divided difference method of interpolation.
7. Define and use Lagrange and spline interpolation.
8. Implement Euler's methods for solving ordinary differential equations.
9. Investigate how step size affects accuracy in Euler's method.
10. Implement and use the Runge-Kutta 2<sup>nd</sup> order method for solving ordinary differential equations.
11. Apply the shooting method to solve boundary-value problems.
12. Describe the finite different method for one-dimensional problems.

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## DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

### LECTURE

week	Topic	Compulsory reading; page number (from ... to ...)	Required tasks (assignments, tests, etc.)	Completion date, due date
1.	...Define and identify special types of matrices. Perform basic matrix operations.	...04.06; 04.08	...List of participants.	...September 3, 2024
3.	...Define and solve linear systems.	...0.4.06; 04.06	...List of participants.	...September 17, 2024
5.	...Define interpolation. Define and use direct interpolation to approximate data and find derivatives.	...05.02	...List of participants.	...October 1, 2024
7.	...1 <sup>st</sup> <b>Midterm Test Examples</b> (structural examples using matrix methods, interpolation techniques for engineering problems).	...04.06; 04.08; 05.02	Written exam using Wolfram Mathematica. Legal license available in room A 117	...October 15, 2024
11.	...Define and use Newton's divided difference method of interpolation. Define and use Lagrange and spline interpolation. Implement Euler's methods for solving ordinary differential equations. Apply the shooting method to solve boundary-value problems.	...05.03; 05.04; 05.05	...List of participants.	...November 12, 2024

13.	2 <sup>nd</sup> <b>Midterm Test Examples</b> (structural examples using Newton, Lagrange, and Euler methods, finite different method for engineering problems).	...05.03; 05.04; 05.05 ...08.01; 08.02; 08.03; 08.04; 08.06; 06.08	Written exam using Wolfram Mathematica. Legal license available in room A 117	...November 28, 2023
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### **PRACTICE, LABORATORY PRACTICE**

<i>week</i>	<b>Topic</b>	<b>Compulsory reading; page number (from ... to ...)</b>	<b>Required tasks (assignments, tests, etc.)</b>	<b>Completion date, due date</b>
1.	...Define and identify special types of matrices. Perform basic matrix operations.	...04.06; 04.08	...List of participants.	...September 3, 2024
3.	...Define and solve linear systems.	...0.4.06; 04.06	...List of participants.	...September 17, 2024
5.	...Define interpolation. Define and use direct interpolation to approximate data and find derivatives.	...05.02	...List of participants.	...October 1, 2024
7.	...1 <sup>st</sup> <b>Midterm Test Examples</b> (structural examples using matrix methods, interpolation techniques for engineering problems).	...04.06; 04.08; 05.02	Written exam using Wolfram Mathematica. Legal license available in room A 117	...October 15, 2024
11.	...Define and use Newton's divided difference method of interpolation. Define and use Lagrange and spline interpolation. Implement Euler's methods for solving ordinary differential equations. Apply the shooting method to solve boundary-value problems.	...05.03; 05.04; 05.05	...List of participants.	...November 12, 2024
13.	2 <sup>nd</sup> <b>Midterm Test Examples</b> (structural examples using Newton, Lagrange, and Euler methods, finite different method for engineering problems).	...05.03; 05.04; 05.05 ...08.01; 08.02; 08.03; 08.04; 08.06; 06.08	Written exam using Wolfram Mathematica. Legal license available in room A 117	...November 26, 2024

## **3. ASSESSMENT AND EVALUATION**

*(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)*

### **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** (e.g.: attendance sheet / online test/ register, etc.)

... attendance sheet and 2 midterm exams

## ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

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### Course resulting in mid-term grade (PTE TVSz 40§(3))

**Mid-term assessments, performance evaluation and their ratio in the final grade** (The samples in the table to be deleted.)

Type	Assessment	Ratio in the final grade
1 <sup>st</sup> Midterm Exam	max 100 points	50 %
2 <sup>nd</sup> Midterm Exam	max 100 points	50 %

### Opportunity and procedure for re-takes

 (PTE TVSz 47§(4))

The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

... Students have the possibility to retake only one Midterm Exam during the semester. The Midterm Exams are compulsory.

### Grade calculation as a percentage

based on the aggregate performance according to the following table

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.

## 4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

### COMPULSORY READING AND AVAILABILITY

[1.] Kaw, Autar K, Kalu, Egwu E and Nguyen, Duc: NUMERICAL METHODS WITH APPLICATIONS, ISBN: 978-3-540-55919-1 (Print) 978-3-642-84845-2 (Online) ([http://nm.mathforcollege.com/topics/textbook\\_index.html](http://nm.mathforcollege.com/topics/textbook_index.html)).