Name of Course	NUMERICAL METHODS FOR CIVIL ENGINEERING
Course Code	**MSM007AN**
Allotment of Hours per Week	**1/0/2**
Number of Credits	**3**
Program	**Structural Engineer (MSc)**
Evaluation	
Semester	**1**
Prerequisites	**BSc subjects**
Department	**Department of Civil Engineering**
Instructor	**Prof. Dr. Anikó Csébfalvi**

OBJECTIVES

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.

Short description:

This course contains 14 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) 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).

Schedule:

1. Define and identify special types of matrices (**September 6, 2022**).
2. Perform basic matrix operations (**September 6, 2022**).
3. Define and solve linear systems (**September 20, 2022**).
4. Define interpolation (**October 4, 2022**).
5. Define and use direct interpolation to approximate data and find derivatives (**October 4, 2022**).
6. 1st **Midterm Test Examples** (structural examples using matrix methods, interpolation techniques for engineering problems) (**October 18, 2022**)
7. Define and use Newton's divided difference method of interpolation (**November 15, 2022**).
8. Define and use Lagrange and spline interpolation (**November 15, 2022**).
9. Implement Euler's methods for solving ordinary differential equations (**November 15, 2022**).
10. Investigate how step size affects accuracy in Euler's method (**November 29, 2022**).
11. Implement and use the Runge-Kutta 2nd order method for solving ordinary differential equations (**November 29, 2022**).
12. Apply the shooting method to solve boundary-value problems (**November 29, 2022**).
13. Describe the finite different method for one-dimensional problems (**November 29, 2022**).
14. 2nd **Midterm Test Examples** (structural examples using Newton, Lagrange, and Euler methods, finite different method for engineering problems) (**December 13, 2022**).

ATTENDANCE AND GRADING

Attendance:

Attending is required all classes, and will impact the grade (max. 10%). Unexcused absences will adversely affect the grade, and in case of absence from more than 30% of the total number of lesson will be grounds for failing the class. To be in class at the beginning time and stay until the scheduled end of the lesson is required, tardiness of more than 20 minutes will be counted as an absence. In the case of an illness or family emergency, the student must present a valid excuse, such as a doctor's note.

Grading:

Grading will follow the course structure with the following weight: **1st Midterm Test Example - 45%,** and **2nd Midterm Test Example - 45%.** The remaining 10% will be assessed according to participation, progress, effort and attitude. Please note that attendance will adversely affect one's grade, both in direct grade reduction and in missing work in the development of a project.

Offered exam grade:

Evaluation in percents	Numeric grade
85%-100%	5
70-84%	4
55%-69%	3
40%-54%	2
0-39%	1

READINGS AND REFERENCE MATERIALS

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).