COURSE SYLLABUS SEMESTER SPRING 2021/2022

Name of Course	**STRUCTURAL OPTIMIZATION**
Course Code	MSM407ANEP
Allotment of Hours per Week	**0/0/3**
Number of Credits	**3**
Program	**Structural Engineer (MSc)**
Evaluation	
Semester	**1**
Prerequisites	**Numerical methods; Structures-1**
Department	**Department of Civil Engineering**
Instructor	**Prof. Dr. Anikó Csébfalvi**

OBJECTIVES

The subject of structural optimization provides a way for structural engineers to extend and generalize their basic knowledge to a computer supported structural analysis and design. The purpose of the subject is to introduce a new concept in structural design, construct more efficient structures, e.g. by making structures as light as possible yet able to carry the loads subjected to them. However, in the last two decades computational tools based on optimization theory have been developed that make it possible to find optimal structures more or less automatically.

Two textbooks are provided to help students to follow the teaching materials and understand the presented computational examples (see: at the end of the syllabus). These textbooks give an introduction to all three classes of geometry optimization problems of engineering structures: sizing, shape and topology optimization

CONTENTS

Short description:

This course contains 14 units (listed below) of selected topics of structural optimization. In order to complete this course, you will need to work through each selected unit and all of its assigned materials in the book AN INTRODUCTION TO STRUCTURAL OPTIMIZATION (Authors: Peter W. **Christensen** and Anders **Klarbring**) and Structural Optimization, Fundamentals and Applications (Author: **Kirsch**, Uri) 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. Modelling of Structural Optimization Problems. Classification of Structural Optimization Problems (**February 8, 2022**)
2. Structural Constraints. Structural modelling. Minimal Weight Design Subject to Stress Constraints (**February 8, 2022**)
3. Minimal Weight Design Subject to Stress and Displacement Constraints (**February 16, 2022**)
4. Minimal Weight Design Subject to Buckling Constraints (Minimal Weight Design Subject to Stress Constraints (**February 16, 2022**)
5. Minimal Weight Design of Three-Bar Truss Subject to Stress Constraints (**March 8, 2022**)
6. Minimal Weight Design of Three-Bar Truss Subject to Stress and Displacement Constraints (**March 8, 2022**)
7. 1st **Midterm Test Examples** (**March 22, 2022**)
8. Optimization of Elasto-Plastic Structures. Limit States (**April 5, 2022**)
9. Plastic Analysis of Continuous Beam (**April 5, 2022**)
10. Plastic Analysis of Three-Bar Truss (**April 5, 2022**)
11. Linear programming. Simplex Method (**May 3, 2022**)
12. Linear Programming of 2D Problem (**May 3, 2022**)
13. Theory of Primal-Dual Linear Problems. The Dual Problem (**May 3, 2022**)
14. 2nd **Midterm Test Examples** (**May 17, 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 percent	Numeric grade
89%-100%	5
76%-88%	4
63%-75%	3
55%-62%	2
0-49%	1

READINGS AND REFERENCE MATERIALS

1. **Kirsch**, Uri: Structural Optimization, Fundamentals and Applications, ISBN: 978-3-540-55919-1 (Print) 978-3-642-84845-2 (Online)
2. **Christensen**, Peter W. and **Klarbring**, Anders: An Introduction to Structural Optimization, Springer Science & Business Media, Oct 20, 2008 - Technology & Engineering - 214 pages