COURSE SYLLABUS SEMESTER

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	**Mid-semester grade**
Semester	**2**
Prerequisites	**Numerical Methods for Civil Engineering**
Department	**Department of Civil Engineering**
Instructor	**Professor emerita dr. Anikó Csébfalvi**

INTRODUCTION, GENERAL COURSE DESCRIPTION

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.

LEARNING OBJECTIVES

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.

1. Modelling of Structural Optimization Problems. Classification of Structural Optimization Problems.
2. Structural Constraints. Structural modelling
3. Minimal Weight Design Subject to Stress Constraints,
4. Minimal Weight Design Subject to Stress and Displacement Constraints
5. Minimal Weight Design Subject to Buckling Constraints.
6. Minimal Weight Design of Three-Bar Truss Subject to Stress Constraints
7. Minimal Weight Design of Three-Bar Truss Subject to Stress and Displacement Constraints
8. Optimization of Elasto-Plastic Structures. Limit States.
9. Plastic Analysis of Continuous Beam
10. Plastic Analysis of Three-Bar Truss
11. Linear programming. Simplex Method
12. Linear Programming of 2D Problem.
13. Linear Programming of 3D Problem
14. Theory of Primal-Dual Linear Problems. The Dual Problem.

Methodology:

The course is based on individual computational skills with regular consultations and presentations.

Schedule:

Continuous learning of students is **controlled two times** during the semester. Therefore, two parts is distinguished and controlled:

- **First part** of the semester content structural optimization methods, modelling of 2D trusses and beam structures, subsequently unit 1-7 (**Week 1, 3, 5, 7**).

- **Second part** of the semester content modelling basics of convex programing, Limit States. Plastic Analysis of Continuous Beam. Plastic Analysis of Three-Bar Truss, LP problems, Simplex method, Lagrangian Duality, subsequently unit 8-14, (**Week 9, 13, 15**).

Each part closes with a graded **Midterm Test Example** from the predetermined topics of the given units. **Location** of the Midterm Test Example: Room A117. **Time**: **Week 7** (**1st Midterm Test Example**) and **Week 15** (**2nd Midterm Test Example**).

Studio Culture:

The course is based on through collaboration, participation and discussions trough lessons. This is an interaction between Students and Faculty; used the teaching methods like ‘Problem-based learning’ and ‘learning-by-doing’. The communication and work should be reflect a respect for fellow students and their desire to work with regard to noise levels, noxious fumes, etc – from each site of participants.

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:

Offered exam grade:

Evaluation in percents	Numeric grade
89%-100%	5
77%-88%	4
66%-76%	3
55%-65%	2
0-54%	1

READINGS AND REFERENCE MATERIALS

1. STRUCTURAL OPTIMIZATION, FUNDAMENTALS AND APPLICATION

Author: Kirsch, Uri

ISBN: 978-3-540-55919-1 (Print) 978-3-642-84845-2 (Online)

http://link.springer.com/book/10.1007%2F978-3-642-84845-2

2. AN INTRODUCTION TO STRUCTURAL OPTIMIZATION

Authors: Peter W. Christensen, Anders Klarbring

Springer Science & Business Media, Oct 20, 2008 - Technology & Engineering - 214 pages

http://www.springer.com/gp/book/9781402086656?wt_mc=GoogleBooks.GoogleBooks.3.EN&token=gbgen

SCHEDULE

		SZORGALMI IDŐSZAK, OKTATÁSI HETEK																			
2019/2020. 2. FÉLÉV		**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**					
Előadás tematika sorszáma																					
Gyakorlat/Labor sorszáma		**1**		**2**		**3**		**4**		**5**				**6**		**7**					
Zárthelyi dolgozat								**1st ME**								**2nd ME**					
Otthoni munka	**kiadása**																				
	beadási határidők																				
Jegyző-könyvek	**beadási határidők**																				
Egyebek	**pl. beszámolók,**																				
	stb.																				
Aláírás / Félévközi jegy megadása																					
Vizsgák tervezett időpontjai																					