General Information:

Name of Course: THEORETICAL BASICS OF STRUCTURAL ANALYSIS

Course Code: PM-RSTNM070OA

Semester:	4nd
Number of Credits:	5
Allotment of Hours per Week:	2 Lectures + 2 Practises /Week
Evaluation:	Examination (with grade)
Prerequisites:	**Mechanics I (Statics - BSc), Mechanics II (Strengths of Materials - BSc)**

Instructor: **Prof Dr Anikó CSÉBFALVI, full professor**
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Introduction, Learning Outcomes:
This course is aimed to provide basic and advanced knowledge on the principles of the calculations of statically indeterminate plane structures.

Topics covered by the course include:

- Computation of displacements of statically determinate structures using principle of virtual work.
- The manual solution of statically indeterminate plane structures by the force method for frames, trusses and continuous beams.
- The manual solution of statically indeterminate plane structures by the displacement method for frames, trusses and continuous beams.
- The manual solution of moment distribution method (Cross-Method) for frames and continuous beams

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.

Upon successful completion of this course, the student will be able to:

1. Principle of Virtual Works; Virtual Force Method
2. Computation of displacements of statically determinate structures using the Virtual Force Method;
3. Statically Determinate and Indeterminate Structures. Degree of Indeterminacy.
4. Force Method for Statically Indeterminate Structures;
5. Computation of Statically Indeterminate Beams using Force Method
6. Computation of Continuously Multiplle Supported Structures using Force Method;
7. Beams with Varying Cross-Sections using Force Method
8. Computation Beams with Sinking of Supports using Force Method
9. Displacement Method for Statically Indeterminate Structures
10. Computation of Beams using Cross-Method
11. Computation of No Side-sway Frames using Cross Method
12. Computation of Side-sway Frames using Cross Method

1. **Requirements for Completion:** This course contains 12 units of selected topics of numerical methods listed above. In order to complete this course, you will need to work through each selected unit and all of its assigned materials in the book Kassimali, A. "Structural Analysis" International Edition (5th ed.), Published by Cengage Learning or Rumman, Wadi S. "Statically Indeterminate Structures" A Wiley-Interscience Publication (1st ed.), (July 3, 1991)

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

In order to take this course, you must: Have access to a computer, frequent broadband Internet access, and ability to download and save files and documents to a computer. Using your personal code, all of the computer skills are available in the course room: PTE MIK, A-116.

You will also need to complete two graded **Midterm Test Examples** and the **Final Exam** (with grade).

General Course Description and Main Content:
Brief Syllabus: The purpose of this course is to introduce students to an advanced knowledge of structural analysis theory of statically indeterminate structures and learn its application for structural engineering problems. The selected topics are focusing for engineering problems and related computational methods. Solution methods are applied and demonstrated with help of Wolfram Mathematica (© 2015 Wolfram. All rights reserved). Legal licensed version available in room A 116.

Student version is free on the web-site: http://www.wolfram.com/solutions/education/students/.

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

- **First part** of the semester content **displacement computation** of statically determinate structures using **principle of virtual forces**, **statically indeterminate structures**, **force method**, determine internal forces of statically indeterminate structures using force method, subsequently unit 1-8 (**Week 1-7**).
- **Second part** of the semester content **displacement method**, determine internal forces of statically indeterminate structures using displacement method, subsequently unit 9-12, (**Week 9-14**).

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 8 (1st Midterm Test Example) and Week 15 (2nd Midterm Test Example). In between the Midterm Test Examples **3 Graded Practices** are required to help the students in continuous learning of the teaching materials.

Syllabus		
Week	Weekly Hours	Topics
1.	2 Lectures 2 Practices	Displacements of statically determinate structures. Displacements of statically determinate structures.
2.	Lecture Practice	Displacements of statically determinate structures. **1st GRADED PRACTICE.**
3.	Lecture Practice	Statically indeterminate structures. Force method. Computation of statically indeterminate structures using force method.
4.	Lecture Practice	Statically indeterminate beam structures using force method. Computation of statically indeterminate beam structures.
5.	Lecture Practice	Statically indeterminate beam structures with varying cross-sections. Computation of beam structures with varying cross-sections.
6.	Lecture Practice	**1ST MIDTERM EXAM (FORCE METHOD)**
7.	Lecture	Statically indeterminate beam structures with settlement supports.

	Practice	Statically indeterminate beam structures with settlement supports.
8.	Lecture Practice	Statically indeterminate beam structures with settlement supports. **2nd GRADED PRACTICE.**
9	Lecture Practice	Statically indeterminate structures. Displacement method. Displacement method for statically indeterminate structures.
10.	Lecture Practice	Statically indeterminate frames. Cross method. Computation of statically indeterminate frames using Cross method.
11.	**SPRING BREAK**	
12.	Lecture Practice	**2ND MIDTERM EXAM (DISPLACEMENT METHOD)**
13.	Lecture Practice	Statically indeterminate displaced frames with Cross method. Statically indeterminate displaced frames with Cross method.
14.	Lecture Practice	Statically indeterminate displaced frames with Cross method. Statically indeterminate displaced frames with Cross method.
15.	Lecture Practice	 **3th GRADED PRACTICE.**

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

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:
Attending is required all classes, and will impact the grade (max. 5%). 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.

Evaluation + Grading
Grading will follow the course structure with the following weight: **1st Midterm Test Example - 40%, 2nd Midterm Test Example - 40%, the 3 Graded Practices 15%.** The remaining 5% 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. The final grade will be based on the following guidelines:

Grading Scale:

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

5. Outstanding work. Execution of work is thoroughly complete and demonstrates a superior level of achievement overall with a clear attention to detail in the production of drawings, models and other forms of representation. The student is able to synthesize the course material with new concepts and ideas in a thoughtful manner, and is able to communicate and articulate those ideas in an exemplary fashion in.

4. High quality work. Student work demonstrates a high level of craft, consistency, and thoroughness throughout drawing and modelling work. The student demonstrates a level of thoughtfulness in addressing concepts and ideas, and participates in group discussions. Work may demonstrate excellence but less consistently than an '5' student.

3 Satisfactory work. Student work addresses all of the project and assignment objectives with few minor or major problems. Graphics and models are complete and satisfactory, exhibiting minor problems in craft and detail.

2. Less than satisfactory work. Graphic and modelling work is substandard, incomplete in significant ways, and lacks craft and attention to detail.

1. Unsatisfactory work. Work exhibits several major and minor problems with basic conceptual premise, lacking both intention and resolution. Physical representation in drawing and models is severely lacking, and is weak in clarity, craft and completeness.

Students with Special Needs:
Students with a disability and needs to request special accommodations, please, notify the Deans Office. Proper documentation of disability will be required. All attempts to provide an equal learning environment for all will be made.

Readings and Reference Materials:

2. Kassimali, A. "Structural Analysis" International Edition (5th ed.), Published by Cengage Learning, ©2015
ISBN10: 1-305-25283-7, **ISBN13:** 978-1-305-25283-7
3. Rumman, Wadi S. "Statically Indeterminate Structures" A Wiley-Interscience Publication (1st ed.), (July 3, 1991)
https://www.amazon.com/Statically-Indeterminate-Structures-Wadi-Rumman/dp/0471093459
ISBN-13: 978-0471093459; **ISBN-10**: 0471093459