General Information:

Name of Course: THEORETICAL BASICS OF STRUCTURAL ANALYSIS

Course Code: PMKSTENE045CA

Semester:	4th
Number of Credits:	5
Allotment of Hours per Week:	2 Lectures + 2 Practises /Week
Evaluation:	Examination (with grade)
Prerequisites:	**Mechanics I (Statics), Mechanics II (Strengths of Materials)**
Instructor:	**Dr Vanda Pomezanski, assistant 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
- Concept of influence lines.

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:

- use the Principle of Virtual Works;
- compute the displacements of statically determinate structures using the Virtual Force Method;
- separate Statically Determinate and Indeterminate Structures, determine the Degree of Indeterminacy;
- use the Force Method for Statically Indeterminate Structures;
- compute Statically Indeterminate Beams by the force Method;
- compute Continuously Multiple Supported Structures by the Force Method;
- calculate Beams with Varying Cross-Sections by the Force Method ;
- use the Displacement Method for Statically Indeterminate Structures;
- compute Beams by the Cross-Method
- compute of No Side-sway Frames by the Cross Method ;
- compute of Side-sway Frames by the Cross Method;
- determine force and displacement influence lines of structures.

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.).

You will also need to complete six **homeworks** to collect points, two **Midterm Test Examples** and the **Final Exam**.

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.
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.
- **Second part** of the semester content **displacement method**, determine internal forces of statically indeterminate structures using displacement method, subsequently.

Each part closes with a graded **Midterm Test Example** from the predetermined topics of the given units.

Syllabus		
Week	Weekly Hours	Topics
1.	Lecture Practice	Introduction Displacements of statically determinate structures.
2.	Lecture Practice	Displacements of statically determinate structures. Work theorems. Calculation of statically indeterminate structures **1st homework**
3.	Lecture Practice	Statically indeterminate structures. Force method. Computation of statically indeterminate structures by force method.
4.	Lecture Practice	Statically indeterminate beam structures by force method. Computation of statically indeterminate beam structures. **2nd homework**
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)** Statically indeterminate structures. Displacement method **3rd homework**
7.	Lecture Practice	Statically indeterminate structures. Displacement method. Computation of statically indeterminate structures by displacement method.
8.	Lecture Practice	Statically indeterminate structures. Displacement method. Statically indeterminate frames. Cross method. **4th homework**
9.	**SPRING BREAK**	
10	Lecture Practice	Statically indeterminate frames. Cross method. Computation of statically indeterminate frames using Cross method. **5th homework**
11.	Lecture Practice	Statically indeterminate frames. Cross method. Computation of statically indeterminate frames using Cross method.

12.	Lecture Practice	**2ND MIDTERM EXAM (DISPLACEMENT METHOD)** Influence lines of statically determinate beam structures
13.	Lecture Practice	Influence lines of statically determinate beam structures Influence lines of statically determinate beam structures. **6th homework**
14.	Lecture Practice	Influence lines of statically indeterminate beam structures. Influence lines of statically indeterminate beam structures.
15.	Lecture Practice	**Repeated test.** **EXAM**

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. 8%**).
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-	**15%,**
2nd Midterm Test-	**15%,**
6 Homework Practices	**30%,**
Attendance	**10%.**
Exam	**30%.**
	100%

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:	95%-100%	85%-94%	70%-84%	55%-69%	0-54%

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.

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Readings and Reference Materials:

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