COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2022/23 SEMESTER 2

Course title	Structural Analysis 3. - Finite Element Modelling
Course Code	MSB386AN (PM-TSTNB042CA)
Hours/Week: le/pr/lab	101
Credits	3
Degree Programme	Civil Engineering Bsc
Study Mode (training schedule)	English course
Requirements	Exam (with grade)
Teaching Period	6.
Prerequisites	Structural Analysis 1.
Department(s)	Department of Civil Engineering
Course Director	Vanda Olimpia Pomezanski Dr., associate professor
Teaching Staff	Vanda Olimpia Pomezanski Dr., associate professor

COURSE DESCRIPTION

This course is aimed to provide basic and advanced knowledge on the principles and solution methods of the finite element method. Topics covered by the course include: General formulations and basic steps of the FEM design. Geometrical finitization, local coordinate systems, calculation of elementary matrixes, the stiffness matrix, the load vector. Controlling methods. Examples like frames, beams, grids, plates, walls, shells. Usage of an industrial code AXIS.

SYLLABUS

[1.] GOALS AND OBJECTIVES

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

[2.] COURSE CONTENT

		TOPICS
LECTURE	1.	Models of 2D and 3D Truss type structures, equilibriums.
	2.	Matrix solution of a 2D Truss. The Matrix of Geometry.
	3.	The State Equation of a Truss. The Stiffness Matrix of a Truss.
	4.	The Flexibility and Stiffness Matrixes of a Beam. FE Models for simple supported beams.
	5.	The elementary stiffness matrixes and the structural stiffness matrixes. Local and global coordinates.
	6.	Plane surfaces like slabs or walls, 3D elements. FE Meshes.
	7.	Plane surfaces like slabs or walls, 3D elements.
LABORATORY PRACTICE	1.	1 Node Model of 2D and 3D Truss type structures, equilibriums.
	2.	Matrix solution of a 2D Truss. The Matrix of Geometry.
	3.	2D Truss with different types of supports: bar support, spring support.
	4.	Statically Indeterminate 2D Truss

5. 2D Truss, Load combinations.
6. The Flexibility and Stiffness Matrixes of a Beam
7. FE Models for simple supported beams, continuous beams and Gerber-beams.
8. Frame Structures.
9. Multi-level frames.
10. Grillages, 3D Frames.
11. The geometrical finitization, the shape functions.
12. Plane surfaces like slabs or walls, 3D elements
13. 3rd Test
14. Summary, Axis documentation

DETAILED SYLLABUS AND COURSE SCHEDULE

LECTURE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	…	…	…	…
2.	**Lecture 1:** Models of 2D and 3D Truss type structures, equilibriums.	[1.], [2.] Lecture 1.		
3.				
4.	**Lecture 2:** Matrix solution of a 2D Truss. The Matrix of Geometry.	[1.], [2.] Lecture 2.		
5.				
6.	**Lecture 3:** The State Equation of a Truss. The Stiffness Matrix of a Truss.	[1.], [2.] Lecture 3.		
7.				
8.	**Lecture 4:** The Flexibility and Stiffness Matrixes of a Beam. FE Models for simple supported beams.	[1.], [2.] Lecture 4.		
9.	Break			
10.	**Lecture 5:** The elementary stiffness matrixes and the structural stiffness matrixes. Local and global coordinates.	[1.], [2.] Lecture 5.		
11.				
12.	**Lecture 6:** Plane surfaces like slabs or walls, 3D elements. FE Meshes.	[1.], [2.] Lecture 6.		
13.				
14.	**Lecture 7:** Plane surfaces like slabs or walls, 3D elements.	[1.], [2.] Lecture 7.		
15.				

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	**Lab.1:** 1 Node Model of 2D and 3D Truss type structures, equilibriums.	[1.], [2.] Lab.1		
2.	**Lab.2:** Matrix solution of a 2D Truss. The Matrix of Geometry.	[1.], [2.] Lab.2		
3.	**Lab.3:** 2D Truss with different types of supports: bar support, spring support.	[1.], [2.] Lab.3		
4.	**Lab.4:** Statically Indeterminate 2D Truss	[1.], [2.] Lab.4		
5.	**Lab.5:** 2D Truss, Load combinations.	[1.], [2.] Lab.5	Test 1.	

6.	**Lab.6:** The Flexibility and Stiffness Matrixes of a Beam	[1.], [2.] Lab.6		Test 1.
7.	**Lab.7:** FE Models for simple supported beams, continuous beams and Gerber-beams.	[1.], [2.] Lab.7		
8.	**Lab.8:** Frame Structures.	[1.], [2.] Lab.8		
9.	Break			
10.	**Lab.9:** Multi-level frames.	[1.], [2.] Lab.9	Test 2.	RT-Test 1
11.	**Lab.10:** Grillages, 3D Frames.	[1.], [2.] Lab.10		Test 2.
12.	**Lab.11:** The geometrical finitization, the shape functions.	[1.], [2.] Lab.11		
13.	**Lab.12:** Plane surfaces like slabs or walls, 3D elements	[1.], [2.] Lab.12		
14.	**Lab.13:** 3rd Test	[1.], [2.] Lab.13	Test 3.	RT-Test 2
15.	**Lab.14:** Summary, Axis documentation	[1.], [2.] Lab.14	RT-Test 3, signature	

[3.] ASSESSMENT AND EVALUATION

ATTENDANCE

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. (7 Lec. + 14 Lab. = 21 meeting. 70% of this is 14,7. Thus you must be attended at least 15 times. Maximum 2 lecture and 4 Labor practice can be missed.)

Method for monitoring attendance: attendance sheet

ASSESSMENT

3 midterm tests.

Tests 1-2 should be submitted by the specified deadline or thereafter, in addition to the payment of a defense fee, by the date of the last lesson in the 14th week. Tests 1-2 must be submitted in print and electronically (TEAMS). Test3 should be written at the time of the schedule. At the end of the diligence period, we provide once a replacement!

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

Type	Assessment	*Weighting as a proportion of the pre-requisite for taking the exam*
1. Test 1	max 50 points	33,3 %
2. Test 2	max 50 points	33,3 %
3. Test 3	max 50 points	33,3 %
sum:	**max 150 points**	**100%**

Requirements for the end-of-semester signature:

Recognition of the semester is subject to minimum of 40% (20 points) each, and of 40% (60 points) for all and attendance at lectures and practice.

Re-takes for the end-of-semester signature:

If the result of Test 3 is under the 40%, the test must be retaken at a given time. If the result of Test 1 or Test 2 is under the 40%, the assignment must be corrected by the given deadline. At the end of the semester, the results of the retake and corrections will be considered.

Type of examination: presentation

The exam is successful if the result is minimum 40%.

Calculation of the grade:

The mid-term performance accounts for **50**%, the performance at the exam accounts for **50**% in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %	Performance in points
excellent (5)	85 % …100%	255- -300
good (4)	70 % ... 85 %	210 - 255
satisfactory (3)	55 % ... 70 %	165 - 210
pass (2)	40 % ... 55 %	120 - 165
fail (1)	below 40 %	0 - 120

The lower limit given at each grade belongs to that grade.

[4.] SPECIFIED LITERATURE

COMPULSORY READING AND AVAILABILITY

[1.] Materials of lectures and practices, uploaded into TEAMS (TEAMS, Files, Class materials)
[2.] Materials of lectures and practices, uploaded into Moodle
[3.] Daryl L. Logan: A first course in the FINITE ELEMENT METHOD, Sixth edition, SI, 2016 USA, ISBN-13: 978-1-305-63734-4, library
[4.]

RECOMMENDED LITERATURE AND AVAILABILITY

[3.] ……
[4.] ……
[5.] ……