MEĐIMURJE POLYTECHNIC IN ČAKOVAC

POLYTECHNIC OF MEĐIMURJE AND ČAKOVEC

SYLLABUS COURSE

ACADEMIC YEAR: 2020/2021

1. GENERAL INFORMATION ABOUT THE COURSE

1.1. Course title	**Load-bearing capacity of structures**			
1.2. Study program (s)	Undergraduate professional study Sustainable Development			
1.3. Course status (O, I)	Mandatory	**1.6. Teaching methods (number of hours)**	**Lectures**	30
1.4. Course code			**Exercises**	30
1.5. Course abbreviation	NK		**Seminar**	
1.6. Semester	I II		**E-learning**	
1.7. Credit value (ECTS)	5	**1.7. Place and time of classes**	Premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website	

2. TEACHING STAFF

2.1. Carrier	mr. sc. Vladimir Križaić, Dražen Hranj	**2.4. Assistant (s)**	mr. sc. Vladimir Križaić, Dražen Hranj
2.2. Calling	s. lecturer lecturer	**2.5. Title (s)**	s. lecturer lecturer
2.3. Contact	vkrizaic @ mev.hr dhranj@mev.hr	**2.9. Contact / s**	vkrizaic @ mev.hr dhranj@mev.hr

3. COURSE DESCRIPTION

3.1. Course objectives	Acquiring knowledge of basic and fundamental principles of mechanics construction and introduced into a branch of static , ie . rigid body equilibrium mechanics. Students must get acquainted with the classification of static systems, statically determined and statically indeterminate systems, observe realistic models of real structures, placement of bearing connections and boundary conditions. Defining all static variables and system resistance on a less demanding object.
3.2. Requirements for enrollment and taking the course	Passed the course Physics for enrollment, course Mechanics and Resistance for taking exams
3.3. Learning outcomes	**After successfully completing the course, students will be able to:** 1. Determine the static system of a static model, according to the classification of the static system 2. Determine the geometric variability and static definiteness of the system 3. Use the resistance of rod structures 4. Know the modulus of elasticity of structures

5. Calculate the engineering cases of static fixed systems: rod system, Gerber support, lattice supports
6. Analytically and graphically determine the internal forces of a statically determined system
7. Graph the internal stresses in simple statically determined constructions
8. Know statically indeterminate systems. Know the application of the FEM method , observe realistic models of real structures, placement of bearing connections and boundary conditions, as an introduction to the dimensioning of simple structures

3.4. Course content

The course presents contents related to classical and modern technology of construction projects

3.5. Types of teaching

x	Lectures	x	Exercises		Blended e-learning	x	Independent tasks		Laboratory
	Seminars and workshops		Distance education		Field work	x	Multimedia and network		Mentoring work
	Other:								

3.6. Performance language

Croatian

3.7. Monitoring student work (enter the number of ECTS credits for each activity so that the total number of ECTS credits corresponds to the credit value of the course, 1 ECTS = 30 hours)

2,0	Class attendance	0,5	Seminar paper		Essay
0,5	Teaching activity		Project		Report
1,0	Colloquia		Practical work		Continuous assessment
(1.0)	Written exam		Experimental work		
1.0	Oral exam		Research		

Seminar paper = colloquium 1

3.8. Assessment and evaluation of student work during classes and at the final exam

Activity specification	**Percentage%**	**points**
Evaluation during classes		
Class attendance	8%	8
Teaching activity	2%	2
Practical work	18%	18
Colloquium 1	36 %	36
Colloquium 2	36 %	36
Evaluation of exam work for students who did not take the colloquium		
Written exam	*90 %*	*9 0*
In total:	**100%**	***100***

3.9. Evaluation criteria - elaboration by outcomes

	Method of passing the outcome					
	Class attendance	**Teaching activity**	**Colloquium 1**	**Colloquium 2**	**Practical work**	**In total**
Outcome 1			10	2. 5		12.5
Outcome 2			10	2.5		12.5
Outcome 3			10	2.5		12.5
Outcome 4			10	2.5		12.5
Outcome 5				10		10
Outcome 6				10		10
Outcome 7				10		10
Outcome 8				10		10

Outside the outcome	8	2				10
In total	**8**	**2**	**40**	**50**	0	**100**

Scoring outcomes (in order to pass the colloquium / exam the student must achieve at least 50% points for each learning outcome)

Rating Points
89 - 100 Excellent (5)
76 - 88 Very good (4)
63 - 75 Good (3)
5 1 - 62 Sufficient (2)
0 - 49 Insufficient (1)

3.10. Specifics related to taking the course

If a student collects 50% of the points of each outcome, he / she directly takes the exam .
If a student does not achieve a sufficient number of points on the midterm exam, he / she cannot take the next midterm exam.
Once achieved points in intermediate exams for each learning outcome are no longer deleted unless the student decides to correct the result for a particular learning outcome, whereby the points won until then are deleted and newly achieved points for that learning outcome are entered.
The final grade is obtained on the exam period and is the sum of points earned during classes.
Students who did not take the colloquium access the written part of the exam where all learning outcomes are checked .

3.11. Student obligations

Full-time students are required to attend at least 70% of the total number of hours of lectures and exercises in order to exercise the right to take the exam.
Part-time students are required to attend at least 30% of the total number of hours of lectures and exercises in order to exercise the right to take the exam.
If the student has not fulfilled all the obligations provided by the course, he is obliged to attend the lectures again and meet the conditions for taking the exam.
Attendance can be offset by online consultations, organized webinars, and added assignments given by teachers. One lesson lasts 45 minutes, and several hours form a teaching unit. Absence from one teaching unit is counted as one absence. Delays and apologies are recorded separately. In that case, if the student missed more than 50% of classes, and has a justifiable reason / apology, a request should be submitted to the Department Council, which then decides on the justification of student absences with the obligatory opinion of the course leader.

3.12. Written works

3.13. Required reading

1.	H. Werner: Technical Mechanics, script, Zagreb, 1986.
2.	V. Simović: Građevna statika I, Građevinski institut, Zagreb, 1988
3.	Ivo Podhorsky , Nosive konstrukcije I , Zagreb: Golden marketing - Tehnička knjiga: Arhitektonsk i fakultet, 2007.
4.	Ivo Podhorsky , Nosive konstrukcije II , Zagreb: Golden marketing - Tehnička knjiga: Arhitektonsk i fakultet, 2008.
5.	Ram, Wagner translated from German Milan Vrečko, Praktična građevinska statika, Beograd: Građevinska knjiga, 1964 -.
1.	M. Anđelić: Statics of indeterminate rod structures, DHGK, Zagreb, 1993; FEAT and TOWER user manual

3.14. Supplementary literature	2.	IA Birger, RR Mavlyutov, Co-operation of Materials, Moscow - Science, 1986
	3.	V. Šimić: Otpornost materijala II, Školska knjiga, Zagreb, 1995
	4.	V. Šimić Resistance of materials I, Školska knjiga, Zagreb, 1992.

4. ADDITIONAL INFORMATION ABOUT THE COURSE	
4.1. Quality control	The quality of the program, teaching process, teaching skills and level of mastery of the material will be established by conducting a written evaluation based on questionnaires, and in other standardized ways and in accordance with the acts of the Polytechnic of Međimurje in Čakovec.
4.2. Contacting the teacher	Students can contact the teacher during the consultation period and during classes, while for short questions and explanations they can contact any day during working hours by coming in person or by landline. It is also possible to ask questions by e-mail, which will be answered in 48 hours at the latest. It is desirable that students come to the consultation as often as possible for any ambiguities.
4.3. Informing about the course	It is the obligation of each student to be regularly informed about the course. All notifications about the holding or possible postponement of classes will be posted on the bulletin board and on the website of the Polytechnic at least 24 hours in advance.
4.4. The contribution of the course to the study program	Apply the basics of building statics through the creation and design of construction projects

5. DEVELOPMENT OF THEMATIC UNITS (the number of elaborated hours is identical to the number of lectures and exercises of the course)

LECTURES

Hours	**Topic and description of the lecture**	**Method of work** • direct teaching (presentation, instruction, pp presentation) • Discovery learning (independent, guided, discussion, debate) • Group / collaborative learning • case study • field teaching…	**Lecture learning outcomes**	**Course learning outcome**
1.	Fundamentals of structural modeling.	Presentation, pp presentation	Distinguish modeling systems	I1
2.	Classification of static systems. Rod flat constructions. Plate flat constructions	Presentation, pp presentation	Distinguish static systems	I1

3.	The notion of geometric invariance and static definiteness. Geometrical characteristics of rod cross section. Steiner's cross-sectional resistance theorem.	Presentation, pp presentation	Distinguish geometric properties of resources	I2
4.	Rod resistance. Basic assumptions of rod resistance. Strength, stresses, stiffness and stability of the rod. Modulus of elasticity and displacement and the limit of elasticity and plasticity.	Presentation, pp presentation	Use resource resilience	I3
5.	Body deformities. Stretching, bending and bending of the rod. Deflections of structures.	Presentation, pp presentation	Distinguish types of body deformations	I4
6.	Classification of flat rod static systems. Statically determined carriers. Classification according to the method of calculation. Structural systems - division of load-bearing structural systems: jogreda,	Presentation, pp presentation	Distinguish static MV and SO systems	I5
7.	Classification of flat rod static systems. Statically determined carriers. Classification according to the method of calculation. Structural systems - Division of load-bearing structural systems: continuous - Gerber girder, three-hinged frame, lattice girders	Presentation, pp presentation	Distinguish SOS	I5
8.	Statically determined single-disk carriers: graphical and analytical calculation procedures	Presentation, pp presentation	Apply SOS	I5
9.	Continuous Gerber supports: analytical calculation procedure. Continuous Gerber supports: application of the superposition principle.	Presentation, pp presentation	Apply SOS-Gerber systems	I5
10.	Three-hinged and related girders (tensioned girders, reinforced, supported and suspended girders): graphical calculation procedures. Graphical and analytical calculation procedures	Presentation, pp presentation	Apply a three-joint system	I6
11.	Work. Virtual displacement theorem. Virtual force theorem. Unit force method.	Presentation, pp presentation	Distinguish displacement methods	I7
12.	Statically indeterminate carriers. Calculation methods of statically indeterminate	Presentation, pp presentation	Use the force method	I7

	carriers. Physical interpretation of force methods			
13.	Physical interpretation of displacement methods.	Presentation, pp presentation	Explain the method of displacement	I7
14.	Iterative procedures. Brief overview of the finite element method. An overview of educational and professional recent FEM software	Presentation, pp presentation	Explain FEM	I7
15.	Spatial statically determined systems: geometric invariance, static definiteness; graphical and analytical calculation procedures	Presentation, pp presentation	Explain spatial statics	I8
EXERCISES / SEMINARS				
Hours	**Topic and description of the lecture**	**Method of work** • direct teaching (presentation, instruction, pp presentation) • Discovery learning (independent, guided, discussion, debate) • Group / collaborative learning • case study • field teaching…	**Lecture learning outcomes**	**Course learning outcome**
1.	Classification of static systems. Rod flat constructions. Plate flat constructions	Presentation, presentation of seminar paper	Distinguish static systems	I1
2.	The notion of geometric invariance and static definiteness. Geometrical characteristics of rod cross section. Steiner's cross-sectional resistance theorem.	Guided assignment - seminar paper, examples of resistance	Distinguish geometric properties of resources	I2
3.	Rod resistance. Basic assumptions of rod resistance. Strength, stresses, stiffness and stability of the rod. Modulus of elasticity and displacement and the limit of elasticity and plasticity.	Guided assignment - seminar paper, modulus of elasticity	Use resource resilience	I3
4.	Body deformities. Stretching, bending and bending of the rod. Deflections of structures.	Guided assignment - seminar paper, bends and sags	Distinguish types of body deformations	I4
5.	Classification of flat rod static systems. Statically determined carriers. Classification according to the method of calculation. Structural systems - division of load-bearing structural systems: jogreda,	Guided assignment - seminar paper, Beam	Distinguish static MV and SO systems	I5

6.	Classification of flat rod static systems. Statically determined carriers. Classification according to the method of calculation. Structural systems - Division of load-bearing structural systems: continuous - Gerber girder, three-hinged frame, lattice girders	Guided assignment - seminar paper, Gerber	Distinguish SOS	I5
7.	Statically determined single-disk carriers: graphical and analytical calculation procedures	Guided assignment - seminar paper, sizing	Apply SOS	I5
8.	Continuous Gerber supports: analytical calculation procedure. Continuous Gerber supports: application of the superposition principle.	Guided task - example	Apply SOS-Gerber systems	I5
9.	Three-hinged and related girders (tensioned girders, reinforced, supported and suspended girders): graphical calculation procedures. Graphical and analytical calculation procedures	Guided task - example	Apply a three-joint system	I6
10.	Work. Virtual displacement theorem. Virtual force theorem. Unit force method.	Guided task - example	Distinguish displacement methods	I7
11.	Statically indeterminate carriers. Calculation methods of statically indeterminate carriers. Physical interpretation of force methods	Guided task - example	Use the force method	I7
12.	Physical interpretation of displacement methods.	Guided task - example	Explain the method of displacement	I7
13.	Iterative procedures. Brief overview of the finite element method. An overview of educational and professional recent FEM software	Guided task - example	Explain FEM	I7
14.	Spatial statically determined systems: geometric invariance, static definiteness; graphical and analytical calculation procedures	Guided task - example	Explain spatial statics	I8
15.	Colloquium	Independent production	To rate	