POLYTECHNIC OF MEĐIMURJE IN ČAKOVEC

COURSE SYLLABUS

ACADEMIC YEAR: 2020/2021

1. GENERAL COURSE INFORMATION				
1.1 Course name	**Mechanics**			
1.2 Study program/s	Undergraduate professional study Sustainable Development			
1.3 Course status (O,E)	Obligation	**1.6 Mode of instruction (number of hours)**	**Lectures**	30
1.4 Course code			**Exercises**	30
1.5 Course abbreviation	ME - TTS		**Seminars**	
1.6 Semester	III		**E-learning**	
1.7 ECTS	5	**1.7 Place and time of instruction**	Premises of the Polytechnic of Međimurje in Čakovec, according to the schedule published on the website	
2. TEACHING STAFF				
2.1 Course leader/s-title	prof. Sarajko Baksa, Ph.D.	**contact**	sbaksa@mev.hr	
	- - -	**contact**	- - -	
2.2 Assistant/s- title	- - -	**contact**	- - -	
	- - -	**contact**	- - -	
2.3 Instruction held by- title	- - -	**contact**	- - -	

3. COURSE DESCRIPTION	
3.1 Course goals	The aim of the course is to enable students to independently create and understand the basic elements of static calculation of mechanical structures, as well as kinematics and dynamics of motion of technical simple and complex systems.
3.2 Prerequisites	They are not defined
3.3 Course outcomes	After successfully passing the course, the student will be able to: 1. Set the equations of equilibrium of a rigid body, decompose the force into components, and calculate the reactions of the bonds with the determination of the resultant force and the resultant moment of the force system. 2. Critically judge and calculate the friction forces of mechanical systems and internal forces in flat and lattice girders. 3. Calculate the position of the center of gravity, as well as the moments of inertia of the cross sections of rods and rigid bodies, determine the amounts and directions of the main moments of inertia, and draw a Mohr circle. 4. Analyze the motion of a material particle and a rigid body in a plane and space, applying Newton's second law in determining the force and dynamic reaction of the motion of a material particle, the system of material particles as well as solids. 5. Calculate mechanical work, force, kinetic energy, potential energy, momentum, momentum and momentum. 6. Set the equations of motion of a material particle, particle system and solid body by applying the law of conservation of kinetic energy, momentum and momentum.

3.4 Course content

The course presents the contents related to the concept, possibilities and role of the concept of the equation of equilibrium of a rigid body, the separation of forces into components, and the calculation of the reaction of connections with the determination of the resultant force and the resultant moment of the force system. Special emphasis is given to the calculation of the position of the center of gravity, as well as the moments of inertia of the cross sections of rods and rigid bodies, with the determination of the amount and directions of the main moments of inertia. Calculation of mechanical work, power, kinetic energy, potential energy, momentum, momentum and momentum.

3.5 Types of coursework

x	Lectures	x	Exercises	x	Blended e-learning	x	Individual activities		Laboratory
x	Seminars and workshops	x	Distant learning	x	Field classes	x	Multimedia and network	x	Mentorship
	Other								

3.6 Language of instruction

Croatian / English

3.7 Monitoring students' work (enter the number of ECTS credits for each activity so that the total number of ECTS credits is equal to the total ECTS value of the course, 1 ECTS = 30 hours)

2,0	Class attendance	0,3	Seminars		Essay
0,3	Class activity	0,3	Project		Report/paper
	Midterm exams	0,3	Practical task	0,3	Continuous knowledge check
1,0	Written exam		Experimental work		
0,5	Oral exam		Research		

3.8 Assessment and evaluation of students' work during classes and at the final exam

Activity specification	Percent %	Points
Assessment during instruction		
Attendance	5%	5
Class activity	5%	5
Project / Practical work	20%	20
Seminar / Colloquium I	20%	20
Seminar / Colloquium II	20%	20
Oral exam	30%	30
Exam assessment for the students who failed to fullfil all the obligatory requirements during the semester		
Written exam	*60%*	*60*
Total:	**100%**	**100**

3.9 Assessment criteria – analysis per learning outcomes

Ways of evaluating learning outcomes							
	Atten-dance	**Activity**	**Project**	**Mid-term exam 1**	**Mid-term exam 2**	**Practic work**	**Total**
Outcome 1			3	6		5	14
Outcome 2			3	6		5	14
Outcome 3			3	8		5	16
Outcome 4			3		6	5	14
Outcome 5			4		6	5	15
Outcome 6			4		8	5	17
Outcome not-related	5	5					10
Total	**5**	**5**	**20**	**20**	**20**	**30**	**100**

The course has defined 6 learning outcomes, a system of scoring outcomes, in order to pass the exam the student must achieve at least 50% points for

	each learning outcome. The grade is calculated as follows: • 87.51-100.00 points: rating Excellent (5) • 75.01- 87.5 points: rating Very good (4) • 62.51 -75.00 points: rating Good (3) • 50.01- 62.5 points: rating Pass (2) • 00.00- 50.00 points: rating Fail (1)	
3.10 Specific features related with taking the course	If the student collects 50% of the points of each outcome, he / she directly takes the exam, provided that he / she has done practical work (seminars / project). During the exam, it is possible to orally check the knowledge from practical work (seminars / project). Once earned points for each learning outcome are no longer deleted unless the student, with the express approval of the course leader, decides to correct the result for each learning outcome, whereby the points won are deleted and newly earned 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, and are required to have completed practical work (seminars / project) before taking the exam.	
3.11 Students 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 set 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 tuition, organised 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, the 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 assignments	Seminars / Projects	
3.13 Required reading	1.	F. Matejiček, D. Semenski, Z. Vnučec: Uvod u statiku sa zbirkom zadataka. Slavonski Brod, Fakultet strojarstva i brodogradnje, 2012.
	2.	Matejiček, F.: Kinematika sa zbirkom zadataka, Strojarski fakultet u Slav. Brodu, 2006.
	3.	Matejiček, F.: Kinetika sa zbirkom zadataka, Strojarski fakultet u Slav. Brodu, 2006.
3.14 Additional reading	1.	O. Muftić: Mehanika 1 - Statika
	2.	S. Jecić: Mehanika 2 – Kinematika i dinamika
	3.	B. Kraut: Strojarski priručnik

4 ADDITIONAL COURSE INFORMATION	
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 standardised ways and in accordance with the by-laws of the Polytechnic of Međimurje in Čakovec.
4.2 Contact the teacher	Students can contact the teacher during the office hours and during classes, while for short questions and explanations they can contact him/her any day during working hours by coming in person or by landline. It is possible to ask questions and e-mail which will be answered as soon as possible.
4.3 Information about the course	It is the obligation of each student to be regularly informed about the course. All relevant information and notices related to classes and exams, maintenance or any year, will be reported in a timely manner on the bulletin board and on the website of the Polytechnic of Međimurje in Čakovec.
4.4 Course contribution to the study program	Course contribution to the study program in generic learning outcomes; I1 - Interpret information, ideas, problems and solutions to professional and General public, I2 - Use new technologies and techniques as part of a lifelong process Learning, I3 - Use foreign languages in professional communication and use of professional literature, I5 - Critically evaluate arguments, assumptions and data in order to create opinions and contributing to the solution of the problem. The contribution of the course to the study program in specific learning outcomes; I6 - Solve engineering problems of sustainable development by applying mathematics, physics, chemistry and biology, I8 - Interdisciplinary to solve engineering problems of sustainable development, I12 - Develop a technical plan in the field of design of Mechanical Thermotechnical System, I14 - Apply and monitor conventional heating, cooling, and ventilation systems and devices, I16 - Propose technical changes and upgrades to conventional ones thermotechnical systems in the direction of sustainable development.

5. ANALYSIS OF COURSE TOPICS (the number of hours is equal to the number of lectures and exercises of the course)

LECTURES

Hours	Topic and description	Method • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	Learning outcomes	Course outcome

1.	Introduction to solid state mechanics. The notion of a rigid body. Basic concepts and units. Newton's laws. Definition and division of forces.	Lecture, Discovery learning, Presentation	Use the basic concepts and units of Newton's laws of definition and division of forces	I1
2.	The rule of displacement of forces. Coupling force and moment force. Vector product. Reduction of spatial and planar system of forces. Release of rigid body bonds. The principle of isolation. Types of connections and supports in mechanics.	Lecture, Discovery learning, Presentation	Distinguish planar and spatial models of force couplings and moments of vector product of forces	I1
3.	Equilibrium of the spatial system of forces. Coplanar forces. The principle of stiffening. Gravitational force.	Lecture, Discovery learning, Presentation	Distinguish models of the spatial coplanar system of forces	I2
4.	Forces of static and kinetic friction, Coulomb's law of friction. Body on a slope. Friction on contact cylindrical surfaces, radial and axial support. Rope friction.	Lecture, Discovery learning, Presentation	Use various forms of static and kinetic friction forces	I2
5.	Beam. Transverse and axial force. Bending moment and torsion moment. Gerber's wrist. Frame and lattice girders.	Lecture, Discovery learning, Presentation	Distinguish transverse and axial forces, as well as bending moment and torsion moment	I3
6.	Geometric characteristics of the body (center of gravity of lines and surfaces, center of gravity of flat plates, static moment of inertia, moments of inertia, Steiner's rule of displacement, Mohr's circle of inertia).	Lecture, Discovery learning, Presentation	Use knowledge of geometric characteristics of body centers of gravity	I3
7.	Introduction to kinematics and dynamics. Material particle kinematics. Trajectory, speed and acceleration. Rectilinear and curvilinear motion of a particle in a plane and space.	Lecture, Discovery learning, Presentation	Apply and distinguish kinematics and dynamics of rectilinear and curvilinear motion of a particle in the plane and space	I4
8.	Body kinematics. Position of a rigid body in space. Solid body translation. Rotation about a fixed axis.	Lecture, Discovery learning, Presentation	Apply spatial representation and analysis of body kinematics	I4
9.	Plane motion. Current pole speed and current pole acceleration. Poloid. Speed and acceleration plan. Spherical motion, angular velocity and angular acceleration	Lecture, Discovery learning, Presentation	Use knowledge of plane and spherical motion, with the application of velocity and acceleration plan	I4
10.	Material particle dynamics. Particle motion equations. D'Alambert's principle.	Lecture, Discovery learning, Presentation	Apply the basic syntax of the dynamics of the equation of motion of a material particle	I5
11.	Mechanical work and power. Kinetic	Lecture, Discovery	Apply the concept	I5

	energy and the law of kinetic energy. Potential energy.	learning, Presentation	of mechanical work and power, kinetic and potential energy	
12.	Law of conservation of mechanical energy. Impulse and amount of motion.	Lecture, Discovery learning, Presentation	Explain the law of conservation of mechanical energy	I5
13.	The law of quantity of motion. Moment of momentum and law of momentum.	Lecture, Discovery learning, Presentation	Explain the law of momentum and the law of momentum	I5
14.	Rigid body dynamics, translation, rotation about a fixed axis.	Lecture, Discovery learning, Presentation	Apply the postulates of the dynamics of a rigid body	I6
15.	Kinetic moment in body rotation. Dynamic reactions in supports. Dynamics of plane motion of a body, equations of motion.	Lecture, Discovery learning, Presentation	Apply the kinetic and dynamic moment of the reaction of the plane motion of a body	I6
EXERCISES/ SEMINARS				
Hours	**Topic and description**	**Method** • Direct teaching (lecture, instruction, pp presentation) • Discovery learning (individual, lead, discussion) • Group learning • Case study • Field classes…	**Learning outcomes**	**Course outcome**
1.	Introduction to solid state mechanics. The notion of a rigid body. Basic concepts and units. Newton's laws. Definition and division of forces.	Lecture, Discovery learning, Presentation	Application of basic concepts and units of Newton's laws definition and division of forces	I1
2.	The rule of displacement of forces. Coupling force and moment force. Vector product. Reduction of spatial and planar system of forces. Release of rigid body bonds. The principle of isolation. Types of connections and supports in mechanics.	Lecture, Discovery learning, Presentation	Explain plane and spatial models of force couplings and moments of vector product of forces	I1
3.	Equilibrium of the spatial system of forces. Coplanar forces. The principle of stiffening. Gravitational force.	Lecture, Discovery learning, Presentation	Apply models of the spatial coplanar system of forces	I2
4.	Forces of static and kinetic friction, Coulomb's law of friction. Body on a slope. Friction on contact cylindrical surfaces, radial and axial support. Rope friction.	Lecture, Discovery learning, Presentation	Apply various forms of static and kinetic friction forces	I2

5.	Beam. Transverse and axial force. Bending moment and torsion moment. Gerber's wrist. Frame and lattice girders.	Lecture, Discovery learning, Presentation	Explain transverse and axial forces, as well as bending moment and torsion moment	I3
6.	Geometric characteristics of the body (center of gravity of lines and surfaces, center of gravity of flat plates, static moment of inertia, moments of inertia, Steiner's rule of displacement, Mohr's circle of inertia).	Lecture, Discovery learning, Presentation	Apply knowledge of geometric characteristics of body centers of gravity	I3
7.	Introduction to kinematics and dynamics. Material particle kinematics. Trajectory, speed and acceleration. Rectilinear and curvilinear motion of a particle in a plane and space.	Lecture, Discovery learning, Presentation	Apply and distinguish kinematics and dynamics of rectilinear and curvilinear motion of a particle in the plane and space	I4
8.	Body kinematics. Position of a rigid body in space. Solid body translation. Rotation about a fixed axis.	Lecture, Discovery learning, Presentation	Develop a spatial representation and analysis of body kinematics	I4
9.	Plane motion. Current pole speed and current pole acceleration. Poloid. Speed and acceleration plan. Spherical motion, angular velocity and angular acceleration	Lecture, Discovery learning, Presentation	Develop a model of planar and spherical motion, using the plan of velocities and accelerations	I4
10.	Material particle dynamics. Particle motion equations. D'Alambert's principle.	Lecture, Discovery learning, Presentation	Build the basic syntax of the dynamics of the equation of motion of a material particle	I5
11.	Mechanical work and power. Kinetic energy and the law of kinetic energy. Potential energy.	Lecture, Discovery learning, Presentation	Apply the concept of mechanical work and power, kinetic and potential energy	I5
12.	Law of conservation of mechanical energy. Impulse and amount of motion.	Lecture, Discovery learning, Presentation	Apply the law of maintenance of mechanical energy	I5
13.	The law of quantity of motion. Moment of momentum and law of momentum.	Lecture, Discovery learning, Presentation	Explain the law of momentum and the law of momentum	I5
14.	Rigid body dynamics, translation, rotation about a fixed axis.	Lecture, Discovery learning, Presentation	Apply the postulates of the dynamics of a rigid body	I6
15.	Kinetic moment in body rotation. Dynamic reactions in supports. Dynamics of plane motion of a body, equations of motion.	Lecture, Discovery learning, Presentation	Create the kinetic and dynamic reaction moment of the plane motion of the body	I6