

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Mechanika i wytrzymałość materiałów**
 Name in English: **Mechanics and strength of materials**
 Main field of study (if applicable): **Control Engineering and Robotics**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **obligatory**
 Subject code: **MMM012014**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30	15			
Number of hours of total student workload (CNPS):	60	30			
Form of crediting:	crediting with grade	crediting with grade			
For group of courses mark (X) final course:					
Number of ECTS points:	2	1			
including number of ECTS points for practical (P) classes :		1			
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40	0.70			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamental knowledge, skills and competences concerning calculus, algebra and analytic geometry and physics.

SUBJECT OBJECTIVES

- C1. . Solving technical problems pursuant to the laws of mechanics.
 C2. Performing strength analyses of structural elements for simple load cases.
 C3. Acquisition and strengthening of the social competence including emotional intelligence that is relying on the ability to cooperate in a group of students, which is aimed at effective problem solving. Responsibility, honesty and diligence in one's code of conduct; obeying the customs of the academic community and society.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Has fundamental knowledge of mechanics. Knows the methods of reduction of forces in the planar and spatial force system and the conditions of their equilibrium. Knows the methods of solving frames and beams.
 PEK_W02 Has organised and theoretically supported knowledge of the strength of materials, including the knowledge which is essential for strength dimensioning in simple load states.
 PEK_W03 Understands fundamental issues concerning elements of the theory of stress and strain states.

relating to skills:

- PEK_U01 Can define the behaviour of a deformable body under load and use the laws of statics and mechanics derived for a deformable body.
 PEK_U02 Can perform the analysis of the stress and strain state and perform the strength dimensioning of bar elements in the elastic range.

relating to social competences:

- PEK_K01 Openness to searching for information and its critical analysis.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Scope of the subject, basic terms and axioms. Force, moment of force with respect to a point. Constraints.	2
Lec 2	Force systems – concurrent, arbitrary, couple of forces. Reduction of forces, conditions of equilibrium.	2
Lec 3	Reduction of spatial force system to resultant force. Active forces and reactions by solid body.	2
Lec 4	Plane trusses: inner and outer statical determination, calculation of the forces in bars using the method of joints, method of sections (the analytical Ritter method).	2
Lec 5	Geometrical characteristics of plane figures. Huygens-Steiner theorem. Rotational transformation of inertia moments.	2
Lec 6	Beams – internal forces, Schwedler theorems, diagrams of internal forces.	2
Lec 7	Strength of materials – principles. Saint-Venant's Principle. Young's modulus and Poisson's ratio. State of stress and strain. Static tensile test.	2
Lec 8	Tension and compression. Strength calculations of bars. Permissible stresses. Safety factors. Statically indeterminate cases.	2
Lec 9	Simple load cases – technical shearing.	2
Lec 10	Simple load cases – torsion.	2
Lec 11	Plane stress. Principal stresses. Mohr's circle.	2
Lec 12	Generalized Hooke's law. State of stress, state of strain.	2
Lec 13	Bending – stresses and displacements. Simple bending of prismatic bars. Żurawski formula.	2
Lec 14	Combined stress – strength criteria/ hypothesis.	2
Lec 15	Final test.	2
Total hours:		30

Form of classes - class		Number of hours:
Cl 1	Elements of the calculus of vectors: addition and subtraction of vectors, scalar and vector product. Equilibrium of concurrent coplanar force system.	2
Cl 2	Coplanar and spatial concurrent force system – systems with bars and ties members, plane and space truss.	2
Cl 3	Friction. Geometrical characteristics of plane figures.	2
Cl 4	Strength calculations of bars (tension and compression).	2
Cl 5	Technical shearing.	1
Cl 6	Strength calculations of axisymmetrical bars subjected to torsion.	2
Cl 7	Strength calculations of bars subjected to bending. Diagrams of internal forces.	2
Cl 8	Final test.	2
Total hours:		15

TEACHING TOOLS USED
<p>N1. Traditional lecture with the use of audio-visual media.</p> <p>N2. Self-study – preparing solutions of homework assignments.</p> <p>N3. Self-study – systematic preparation for the next topics.</p> <p>N4. Self-study – preparation for the final test.</p> <p>N5. Tutorial.</p>

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F – forming (during semester)</i> <i>P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEK_W01 PEK_W02 PEK_W03 PEK_K01	Written-oral test
P(w)	P=F1	
F1(c)	PEK_U01 PEK_U02 PEK_K01	Oral answers.
F2(c)	PEK_U01 PEK_U02 PEK_K01	Written test.
P(c)	P=0,3F1+0,7F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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| <ol style="list-style-type: none">1. B. Gabryszewska, A. Pszonka, „Mechanika”, cz. I, Statyka, PWr , 19882. J. Zawadzki, W. Siuta, „Mechanika ogólna”, PWN, Warszawa 19713. Misiak J., „Mechanika ogólna. Statyka i kinematyka”. Tom 1, WNT, Warszawa 1993,4. W. Siuta, „Mechanika techniczna”, WNT, Warszawa 1968,5. Jakubowicz A., Orłóś Z.: Wytrzymałość materiałów, WNT, Warszawa, 19846. Niezgodziński M.E. Niezgodziński T.: Wytrzymałość materiałów, WN PWN, Warszawa, 20097. Niezgodziński M.E. Niezgodziński T.: Zadania z wytrzymałości materiałów, WNT, W-a, 20128. Rajfert T., Rżysko J.: Zbiór zadań ze statyki i wytrzymałości materiałów, PWN, Warszawa, 1976 |
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SECONDARY LITERATURE:

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| <ol style="list-style-type: none">1. Giergiel J.: Mechanika ogólna, WNT, Warszawa 1980,2. Malinin N.N.: Rżysko J.: Mechanika materiałów, PWN, Warszawa, 19813. Brzoska Z.: Wytrzymałość materiałów, PWN, Warszawa, 19794. Niezgodziński M.E. Niezgodziński T.: Wzory, wykresy i tablice wytrzymałościowe, WNT, Warszawa, 2009 |
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SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
MMM012014 - Mechanics and strength of materials
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1AiR_W10	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3 N.5
PEK_W02	K1AiR_W10	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3 N.5
PEK_W03	K1AiR_W10	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3 N.5
PEK_U01	K1AiR_U08	C.2	CI1 CI2 CI3 CI4 CI5 CI6 CI7	N.2 N.3 N.4
PEK_U02	K1AiR_U08	C.2	CI1 CI2 CI3 CI4 CI5 CI6 CI7	N.2 N.3 N.4
PEK_K01	K1AiR_K01	C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15 CI1 CI2 CI3 CI4 CI5 CI6 CI7 CI8	N.1 N.2 N.3 N.4 N.5