MODULE DESCRIPTION

Module code	**Z-ZIP-0133**
Module name	**Wytrzymałość materiałów**
Module name in English	**Strength of Materials**
Valid from academic year	**2016/2017**

A. MODULE PLACEMENT IN THE SYLLABUS

Field of study	**Management and Production Engineering**
Level of education	**1st degree** *(1st degree / 2nd degree)*
Studies profile	**General** *(general / practical)*
Form and method of conducting classes	**Full-time** *(full-time / part-time)*
Specialisation	**All**
Unit conducting the module	**The Department of Production Engineering**
Module co-ordinator	**Dariusz Bojczuk, PhD hab., Eng., Professor of the University**
Approved by:	

B. MODULE OVERVIEW

Type of subject/group of subjects	**Major** *(basic / major / specialist subject / conjoint / other HES)*
Module status	**Compulsory** *(compulsory / non-compulsory)*
Language of conducting classes	**English**
Module placement in the syllabus - semester	**4th semester**
Subject realisation in the academic year	**Summer semester** *(winter semester/ summer)*
Initial requirements	**No requirements** *(module codes / module names)*
Examination	**Yes** *(yes / no)*
Number of ECTS credit points	**4**

Method of conducting classes	Lecture	Classes	Laboratory	Project	Other
Per semester	**30**	**15**			

C. TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Module target	The aims of the module include the following: acquiring knowledge and skills as regards basic quantities describing deformable bodies (stress, dislocation, and strain) as well as basic issues connected with the behaviour and safety of the construction (simple cases of tensile strength tests, tensile strength hypotheses, buckling, etc.).

Effect symbol	Teaching results	Teaching methods *(l/c/lab/p/other)*	Reference to subject effects	Reference to effects of a field of study
W_01	A student has basic knowledge of quantities describing the behaviour of deformed bodies, e.g. stress, dislocation, and strain; a student also understands the meaning of their universality.	l/c	K_W02	T1A_W01 T1A_W02 T1A_W07
W_02	A student has knowledge of simple cases of tensile strength tests concerning rod constructions such as: tension, shearing, bending, and torsion.	l/c	K_W02	T1A_W01 T1A_W02 T1A_W07
W_03	A student knows the selected materials and constructions safety issues such as: tensile strength hypotheses, the selected energy theorems and methods, the elements of the thin plate theory, the fundamentals of the construction stability analysis, as well as the phenomenon of metal fatigue.	l/c	K_W02	T1A_W01 T1A_W02 T1A_W07
U_01	A student can make simple analyses for simple cases of tensile strength tests such as: tension, shearing, bending, and torsion.	c	K_U17	TA1_U09
U_02	A student can make simple analyses as regards determining rod construction dislocations. A student can also calculate reduced stresses and determine critical loads.	c	K_U17	TA1_U09
U_03	A student has the ability to assess the usefulness of tensile strength analyses in solving simple engineering issues.	l/c	K_U19	TA1_U15
K_01	A student understands the necessity of continuous improving his/her knowledge as regards the strength of materials.	l/c	K_K01	TA1_K01

Teaching contents:

1. Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	The fundamentals of the strength of materials, tasks, subject assumptions and simplifications. Material models, the classification of construction models. Stress vector and the state of stress at a point.	W_01 U_03 K_01
2	Plane stress analysis – transformation, determining main directions, and Mohr's circle. The dislocation vector. The state of strain at a point – unit elongations, non-dilatational strain, geometric relationships, and main directions.	W_01 K_01
3	Basic physical structures, soft and high-carbon steel tension diagram. Hooke's law in simple stress. Generalised Hooke's law.	W_01 K_01
4	The geometry of a rod cross-section – centres of gravity, axial and polar moments of inertia of a cross-section. Main central inertia axes of a cross-section.	W_02 K_01

5	Internal forces in a rod, the classification of cases of tensile strength tests. Tension – the analysis of dislocation, strains, and stresses; the condition of tensile strength.	W_02 U_03 K_01
6	The cases of statically indeterminable tension, stresses caused by installation errors. Thermal stresses.	W_02 U_03 K_01
7	Torsion of rods with a circular cross-section; the analysis of strains and stresses; maximum stresses and shaft torsion angle, tensile strength condition.	W_02 U_03 K_01
8	Bending, shearing forces and bending moments; the description of beam strains as a result of bending; the analysis of stresses in a bended rod; tensile strength condition.	W_02 U_03 K_01
9	Tangential stresses during bending. Beam deflection lines, differential equation of a deflection line.	W_02 K_01
10	Strain energy – dilatational and non-dilatational strain energy. Tensile strength hypotheses – the Huber-Misers-Hencky hypothesis; the hypothesis of the largest tangential stresses.	W_03 K_01
11	Practical utilisation of tensile strength hypotheses to analyse complex cases of tensile strength of a rod.	W_03 U_03 K_01
12	Rod buckling – Euler's formula; slenderness ratio and limiting slenderness ratio; elastic and plastic buckling.	W_03 U_03 K_01
13	Rod construction strain energy; Maxwell-Betti reciprocal work theorem; determining dislocation in rod systems with the Maxwell-Mohr method.	W_03 K_01
14	Thee elements of the thin plate theory: assumptions and basic relationships.	W_03 K_01
15	Stress concentration. Fatigue of materials.	W_03 U_03 K_01

2. Teaching contents as regards classes

Class number	Teaching contents	Reference to teaching results for a module
1	The analysis of plane stresses – determining main stresses, transformation of the state of stress. The analysis of the state of stress.	W_01 K_01
2	Determining centres of gravity as well as axial and polar moments of inertia of a rod cross-section. Determining main central inertia axes and main central inertia moments.	W_02 U_01 K_01
3	Calculating stresses, strains, and dislocations in rods subject to tensions, the condition of tensile strength. The cases of statically indeterminable tension.	W_02 U_01 U_03 K_01
4	Test 1 Bending of rods with a circular cross-section, maximum stresses and the shaft torsion angle; the condition of tensile strength.	W_01 W_02 U_01 U_03 K_01
5	The diagrams of shearing forces and bending moments in bonded rods; determining stresses in a bonded rod.	W_02 U_01 U_03 K_01
6	Determining deflection lines of bonded rods. The analysis of the selected cases concerning complex tensile strength.	W_02 W_03 U_01 U_02 U_03 K_01

7	The analysis of stability of compressed rods. Determining dislocations in rod systems with the Maxwell-Mohr method.	W_03 U_02 U_03 K_01
8	Test 2	W_02 W_03 U_01 U_02 U_03 K_01

3. Teaching contents as regards laboratory classes

Laboratory class number	Teaching contents	Reference to teaching results for a module

4. The characteristics of project assignments

The methods of assessing teaching results

Obtaining a credit for the classes on the basis of two tests and homework assignments.

Obtaining a credit for the lecture on the basis of a written exam comprising simple tasks and questions which can include calculation elements.

Effect symbol	**Methods of assessing teaching results** *(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)*
W_01	A written examination, a final test during the classes.
W_02	A written examination, final tests during the classes, homework assignments.
W_03	A written examination, a final test during the classes.
U_01	A written examination, final tests during the classes, homework assignments, students' active participation in the classes.
U_02	A written examination, final tests during the classes, homework assignments, students' active participation in the classes.
U_03	A written examination, final tests during the classes, students' active participation in the classes.
K_01	A written examination, final tests during the classes, comments during the classes and a discussion during the classes.

D. STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	**Student's workload**
1	Participation in lectures	**30**
2	Participation in classes	**15**
3	Participation in laboratories	
4	Participation in tutorials (2-3 times per semester)	**6**
5	Participation in project classes	
6	Project tutorials	
7	Participation in an examination	**3**
8		
9	**Number of hours requiring a lecturer's assistance**	**54** *(sum)*
10	**Number of ECTS credit points which are allocated for assisted work** *(1 ECTS point=25-30 hours)*	**2.2**
11	Unassisted study of lecture subjects	**10**
12	Unassisted preparation for classes	**18**
13	Unassisted preparation for tests	**15**
14	Unassisted preparation for laboratories	
15	Preparing reports	
15	Preparing for a final laboratory test	
17	Preparing a project or documentation	
18	Preparing for an examination	**15**
19		
20	**Number of hours of a student's unassisted work**	**58** *(sum)*
21	**Number of ECTS credit points which a student receives for unassisted work** *(1 ECTS point=25-30 hours)*	**2**
22	**Total number of hours of a student's work**	**112**
23	**ECTS points per module** *1 ECTS point=25-30 hours*	**4**
24	**Work input connected with practical classes** *Total number of hours connected with practical classes*	**51**
25	**Number of ECTS credit points which a student receives for practical classes** (1 ECTS point=25-30 hours)	**2**

E. LITERATURE

Literature list	A. Lectures 1. Niezgodziński M. E., Niezgodziński T., *Wytrzymałość materiałów*, PWN, Warszawa 2002. 2. Gierulski W., Miksa M., Radowicz A., *Mechanika techniczna,* Politechnika Świętokrzyska, Skrypt 291, Kielce 1996. 3. Jakubowicz A., Orłoś Z., *Wytrzymałość materiałów*, WNT, Warszawa 1984 (lub inne wydania). 4. Piechnik S., *Wytrzymałość materiałów dla wydziałów budowlanych*, PWN, Warszawa 1980. 5. Konarzewski Z., *Podstawy technicznej mechaniki ciała stałego*, WNT, Warszawa 1985.

	B. Classes 1. Niezgodziński M. E., Niezgodziński T., *Zadania z wytrzymałości materiałów*, WNT, Warszawa 2001. 2. Barchan A., Wójcik S., *Mechanika techniczna. Zbiór zadań z rozwiązaniami*, Politechnika Świętokrzyska, Skrypt 247, Kielce 1994. 3. Banasiak M., Grossman K., Trombski M., *Zbiór zadań z wytrzymałości materiałów*, PWN, Warszawa 1998. 4. Bojczuk M., Duda I., *Wytrzymałość materiałów. Teoria i przykłady obliczeń. T I, II.* Politechnika Świętokrzyska, Skrypty 331, 335; Kielce 1998.
Module website	