

# MODULE DESCRIPTION

Madula anda	full-time studies:	Z-ZIP1-E-633b				
	part-time studies:	Z-ZIPN1-E-633b				
Module name	Some Aspects of Materials Strength					
Module name in Polish	Wybrane aspekty wytrzymałości materiałów					
Valid from academic year	2019/2020					

#### MODULE PLACEMENT IN THE SYLLABUS

Field of study	MANAGEMENT AND PRODUCTION ENGINEERING
Level of education	1st degree
Studies profile	General
Form and method of conducting classes	Full-time and Part-time
Specialisation	Production and Innovation Management
Unit conducting the module	Department of Production Engineering
Module co-ordinator	Wiesław Trąmpczyński, PhD, DSc, ProfTit
Approved by:	Dariusz Bojczuk, PhD, DSc

#### **MODULE OVERVIEW**

Type of subject / group of subjects	Specialist subject
Module status	Non-compulsory
Language of conducting classes	English
Module placement in the syllabus - semester	Semester VI
Initial requirements	No requirements
Examination (YES/NO)	NO
Number of ECTS credit points	1

Method of c	onducting classes	Lecture	Classes	Laborato- ry	Project	Other
Per	full-time studies:	15				
semester	part-time studies:	9				

Category	Symbol	Learning outcomes	Assignations to the directional learning out- comes
	W01	A student has knowledge of selected issues in the me- chanics and strength of materials, provided in English.	ZIP1_W02
Knowledge	W02	Has knowledge in the field of damage / wear of materials and structures subjected to various loads in operating conditions, provided in English.	ZIP1_W07
	W03	Has knowledge of the life cycle of products subjected to the influence of active environments, provided in Eng- lish.	ZP1_W15
Skills	SkillsU01Has the ability to communicate in English, taking into account technical vocabulary related to mechanics and the strength of materials and structures.Social petencesK01Understands the need for personal development in the field of the strength of materials and structures in order to improve professional qualifications related to the con- tinuous development of this knowledge.K02Is aware of the importance of professional action with the use of knowledge obtained in English.		ZIP1_U05
Social competences			ZIP1_K01
			ZIP1_K03

### TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

## **TEACHING CONTENTS**

Method of conducting classes	Teaching contents
Lecture	<ul> <li>Strength definition and safety factors. Concepts of normal and shear stresses. U.S.</li> <li>Customary System (UCSC) and International System (SI) of units. Linear-elastic strains. Tensile test of cylindrical specimens; engineering stress -strain curve, fracture surfaces. Loading and unloading of elasto-plastic material.</li> <li>True stress-strain curve; definitions of true stress and true strain. Power law with strain hardening exponent. Influence of temperature and strain rate. Normal and planar anisotropy.</li> <li>General and principal stress states. Types of stress states. Equivalent stress. Fracture during compression. Notch effect. Failure examples; fatigue fracture at notches, casting defects, plastic permanent deformation, creep deformation.</li> <li>Microstructure considerations as regarding strength of materials and machine parts.</li> <li>Primary chemical bonds. Metallic crystal structures. Theoretical strength of solids.</li> <li>Imperfections in metallic crystal structures. Plastic deformation by dislocation motion.</li> <li>Mechanical testing of strength; basic tests, hardness tests, Charpy V-notch impact test, Transition temperature.</li> <li>Foundation of fracture mechanics. Analysis of the Liberty Ship cases. Fracture mechanics; Griffith's theory on critical energy release to create cracked surfaces. Crack surface displacement modes.</li> <li>Fracture mechanics in solids with cracks. Mechanism of brittle fracture and plastic separation. Effect of crack on strength. Stress intensity factor. Cyclic loading. Fatigue crack growth rate. Paris law. Crack tolerant approach for ships and aircrafts</li> </ul>

### METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes (select X)							
	Oral exam	Written exam	Test	Project	Statement	Other		
W01						Х		
W02						Х		
W03						Х		
U01						Х		
K01						Х		
K02						Х		

## FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Credit with grade	Assessment of the preparation of the text of the paper and its oral completion

## STUDENT WORKLOAD

Balance of ECTS points												
No	No. Type of student's activity		Student's workload									
INO.			full-time					part-time				
1	4 Destining the section is the		С	Lb	Ρ	0	Lc	С	Lb	Ρ	0	h
1.		15					9					11
2.	Other (consultation, exam)	2					2					h
3.	Number of hours of a student's as- sisted work		17					11				
4.	Number of ECTS credit points which are allocated for assisted work	0,7					0,4					ECTS
5.	Number of hours of a student's un- assisted work		8					14				
6.	Number of ECTS credit points which a student receives for unassisted work		0,3					0,6				
7.	Work input connected with practical classes	0					0					h
8.	Number of ECTS credit points which a student receives for practical classes	0,0					0,0					ECTS
9.	Total number of hours of a stu- dent's work	25 25								h		
10.	Punkty ECTS za moduł 1 ECTS=25 hours	1							ECTS			

#### LITERATURE

- Dowling N. E. (2012), Mechanical Behavior of Materials Engineering Methods for Deformation, Fracture and Fatigue, 4th Edition, Pearson (or 1<sup>st</sup> Edition, 1993, Prentice-Hall International, Inc. USA)
- 2. Becker W.T., Shipley R.J. (2002), *Failure Analysis and Prevention*, ASM Handbook, Vol.11, 10th Edition, ASM International, Materials Park, OH, USA.
- 3. Kalpakjian S. (2014), *Manufacturing Engineering and Technology*, 7th Edition, Pearson Education South Asia Pte Ltd., Singapore (available also on the website www.academia.edu)
- 4. https://en.wikipedia.org/wiki/Liberty\_ship
- 5. Websites indicated at the lecture by the course coordinator.