SYLLABUS OF A MODULE

Polish name of a module	**Mechanika materiałów i analiza wytrzymałościowa elementów konstrukcji**
English name of a module	**Mechanics of materials and strength analysis of construction elements**
ISCED classification - Code	0715
ISCED classification - Field of study	*Mechanics and metal trades*
Languages of instruction	*English*
Level of qualification: ***1 – BSc (EQF 6)*** ***2 – MSc (EQF 7)*** ***3 – PhD (EQF 8)***	*1 – BSc (EQF 6)*
Number of ECTS credit points	*5*
Examination: ***EO – exam oral*** ***EW – exam written*** ***A - assignment***	*EW – exam written*

Number of hours per semester:

Lecture	Tutorials	Laboratory	Seminar	E-learning	Project
15 E	15	30	0	0	0

MODULE DESCRIPTION

MODULE OBJECTIVES

O1. Provide theory of complex strength of materials. O2. Provide theory of mechanics of materials.

O3. To acquire capabilities to perform strength analysis of construction elements and to perform laboratory test of thermomechanical properties of materials as well as numerical modelling of chosen issues of mechanics of materials using selected computer software.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of mechanics and strength of materials.
2. Safety rules during the use of laboratory equipment.
3. Capability of individual work and collaboration in a group.

4. Data analysis and presentation of results.

LEARNING OUTCOMES

LO 1 – Knowledge on complex strength of materials analysis.

LO 2 – Knowledge on basics of mechanics of materials.

LO 3 – Ability to predict stress in loaded construction elements and to test material properties.

MODULE CONTENT

Type of classes – lecture	**Number of hours**
Lec 1-2 - Internal forces, stress and strain tensor, constitutive relations	**2**
Lec 3-4 – Tension, bending, shear and torsion	**2**
Lec 5-6 - Strength of materials in compound stress. Strength hypotheses	**2**
Lec 7 - Combined stresses	**1**
Lec 8 - Deformation of beams due to bending	**1**
Lec 9 - Mechanical properties of materials, material isotropy and anisotropy	**1**
Lec 10 The structure of materials, material polycrystalline	**1**
Lec 11-12 - Thermomechanical properties, methods of determination of stress and strain	**2**
Lec 13 - Linear and non-linear materials in elastic and plastic range	**1**
Lec 14 – Creep - the theory of viscoelastic	**1**
Lec 15 – Fatigue - models of the formation of micro-cracks fatigue	**1**
Sum	**15**
Type of classes– tutorials	**Number of hours**
T 1-2 - Internal forces in prismatic bars	**2**
T 3-4 – Properties of a plane area	**2**
T 5-6 – Tension, compression and bending	**2**
T 7 – Eccentric tension and compression	**1**
T 8 - Shear and torsion	**1**
T 9-10 - Combined stresses – strength hypotheses	**2**
T 11-12 - Deformation of beams. Statically indeterminate systems – 1D and 2D problem	**2**
T 13-14 - Castigliano-Menabrei energetic methods	**2**
T 15 – Buckling of beams	**1**
Sum	**15**
Type of classes– laboratory	**Number of hours**

Lab 1-4 - Hardness testing, (Brinell, Poldi, Rockwell, Vickers)	**4**
Lab 5-8 - Tension test	**4**
Lab 9-10 - Compression test	**2**
Lab 11-12 – Bending test	**2**
Lab 13 – Impact test - Charpy	**1**
Lab 14-17 – Deflection test on beam	**4**
Lab 18-19 – Dilatometric test	**2**
Lab 20-23 - Measurement of stresses with bond wire strain gauges	**4**
Lab 24-25 - Photoelastic method for stress state analysis	**2**
Lab 26-27 - Determination of fatigue strength	**2**
Lab 28-30 –Numerical modelling of displacement in mechanically loaded bars	**3**
Sum	**30**

TEACHING TOOLS

1 - lecture with the use of multimedia presentations
2 - experimental stands equipped with measuring instrumentation
3 - computer laboratory, software for FEM simulation of construction
4 - instructions to laboratory exercises

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. - assessment of preparation for laboratory exercises
F2. - assessment of the ability to apply the acquired knowledge while doing the exercises
F3. - evaluation of reports on the implementation of exercises covered by the curriculum
F4. - assessment of activity during classes
S1. - assessment of the ability to solve the problems posed and the manner of presentation obtained results - pass mark *
S2. - assessment of mastery of the teaching material being the subject of the lecture - exam

*) in order to receive a credit for the module, the student is obliged to attain a passing grade in all laboratory classes as well as in achievement tests.

STUDENT'S WORKLOAD

L.p.	**Forms of activity**	**Average number of hours required for realization of activity**
1. Contact hours with teacher		
1.1	Lectures	15
1.2	Tutorials	15

1.3	Laboratory	30
1.4	Seminar	0
1.5	Project	0
1.6	Consulting teacher during their duty hours	5
1.7	Examination	5
	Total number of contact hours with teacher:	70
2. Student's individual work		
2.1	Preparation for tutorials and tests	15
2.2	Preparation for laboratory exercises, writing reports on laboratories	15
2.3	Preparation of project	0
2.4	Preparation for final lecture assessment	10
2.5	Preparation for examination	5
2.6	Individual study of literature	10
	Total number of hours of student's individual work:	55
	Overall student's workload:	125
Overall number of ECTS credits for the module		5 ECTS
Number of ECTS points that student receives in classes requiring teacher's supervision:		2,60 ECTS
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects:		2,40 ECTS

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Blake A.: Handbook of Mechanics, Materials, and Structures, 1985
2. Silva V. D.: Mechanics and Strength of Materials, 2006
3. Ross Carl T.F., Case J., Chilver A., Strength of materials and Structures, Elsevier, 1999
4. Patnaik S., Hopkins D., Strength of Materials, A New Unified Theory for the 21 Century, Elsevier,
2004
5. Timoshenko S.: Strength of materials, part I, part II, Van Nostrand Company, Inc. 1956
6. Shigley J.: Applied Mechanics of Materials, 1976

MODULE COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

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