SYLLABUS OF A MODULE

Polish name of a module	**Wytrzymałość Materiałów**
English name of a module	**Strength of materials**
ISCED classification - Code	0715
ISCED classification - Field of study	*Mechanics and metal trades*
Languages of instruction	*English*
Level of qualification:	*1 – BSc (EQF 6)*
Number of ECTS credit points	*6*
Examination:	*A - assignment*
Available in semester:	*A – autumn only*

Number of hours per semester:

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

MODULE DESCRIPTION

MODULE OBJECTIVES

O1. Knowledge of basics of strength of materials in terms of classical approach.
O2. Practical skills in the analysis of the behavior of the body subjected to external forces and performing simple strength calculations.
O3. Practical skills in determining the mechanical properties of materials.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematic and static in mechanics.
2. Knowledge of safety rules when using laboratory equipment.
3. Ability to perform mathematical activities to solve the assigned tasks.
4. Ability to use of different sources of information and technical drawings.
5. Ability to work independently and in a group.
6. Ability to interpretation and presentation of obtained results.

LEARNING OUTCOMES

LO1 - Theoretical knowledge in terms of simple strength of materials.
LO2 - General knowledge about stress and strain tensor, constitutive relations, plane stress and strain states.
LO3 - Ability to define internal forces in beams and geometrical properties of the cross section of beams.

LO4 - Calculate stress, strain and displacement in bars and beams for usually used cross sections in engineering practice. Use strength hypotheses to determine cross section geometry.
LO5 - Knows the operating principles of selected laboratory equipment in strength of materials laboratory.
LO6 - Determine the measurement method and perform measurements of mechanical properties of materials.
LO7 - Prepare a test report from the laboratory.

MODULE CONTENT

Type of classes – lecture	**Number of hours**
Lec 1-2 – Internal forces, internal forces diagrams.	2
Lec 3-4 – Moment of inertia of a plane area, polar moment of inertia, product of inertia, Steiner theorem.	2
Lec 5 – Principal central moments of inertia, central principal axes.	1
Lec 6 – Tension and compression, normal stress and strain, stress-strain diagrams, Hooke's Law, Young's modulus.	1
Lec 7 – Stress and strain tensor, constitutive relations.	1
Lec 8 – Shear stress and strain, pure shear, shear modulus – modulus of rigidity, shear stress in beams.	1
Lec 9 – Torsion of round shafts, stress in torsion, relation between Young's and shear modulus, section modulus.	1
Lec 10-11 – Stress in pure bending, curvature of beams, combined stress – bending and tension or compression, normal stress diagrams, axial section modulus, eccentric compression or tension.	2
Lec 12-13 – Strength hypotheses, maximum shear stress theory, strain energy of distortion theory.	2
Lec 14 – Compound stresses, permissible stress.	1
Lec 15 – Deformation of beams.	1
Sum	**15**
Type of classes– tutorials	**Number of hours**
Exe 1,2 – Internal forces, internal forces diagrams.	2
Exe 3-5 – Moment of inertia of a plane area, polar moment of inertia, product of inertia, Steiner theorem. Principal central moments of inertia, central principal axes.	3
Exe 6-8 – Stress in pure bending, combined stress – bending and tension or compression, normal stress diagrams, eccentric compression or tension.	3
Exe 9,10 – Shear stress, Żurawski formula.	2
Exe 11 – Torsion of round shafts. Torsional moments, shear stress due to torsion.	1
Exe 12-13 – Compound stress, bending and torsion of round shafts, bending and shear in beams.	2
Exe 14 – Design criteria.	1
Exe 15 – Deformation of beams due to bending, Clebsch method.	1
Sum	**15**
Type of classes– laboratory	**Number of hours**
Lab 1-3 – Brinell and Poldi hardness tests.	3
Lab 4-6 – Rockwell and Vickers hardness tests.	3
Lab 7-8 – Measurement of impact strength of metals.	2
Lab 9-11 – Tension test using Zwick/Roell materials testing machine.	3

Lab 12-14 – Compression test using Zwick/Roell materials testing machine.	3
Lab 15-16 – Measurement of stress with bond wire strain gauges.	2
Lab 17-18 – Measurement of deflection in straight beams	2
Lab 19-20 – Bending test using Zwick/Roell materials testing machine.	2
Lab 21-30 – Computer modelling of deformation and stress in beams using Abaqus/FEA.	10
Sum	**30**

TEACHING TOOLS

1 - lecture with the use of multimedia presentations and computer equipped with the proper software including Abaqus/FEA.
2 – laboratories equipped with measuring apparatus and computer software
3 – Instructions for laboratory classes and templates of test reports

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	Examination	0
	Total number of contact hours with teacher:	60
2. Student's individual work		
2.1	Preparation for tutorials and tests	20
2.2	Preparation for laboratory exercises, writing reports on laboratories	30
2.3	Preparation of project	0
2.4	Preparation for final lecture assessment	20
2.5	Preparation for examination	0
2.6	Individual study of literature	20

Total number of hours of student's individual work:	90
Overall student's workload:	150
Overall number of ECTS credits for the module	6 ECTS
Number of ECTS points that student receives in classes requiring teacher's supervision:	2,40 ECTS
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects:	3,20 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. Z.Dyląg, A.Jakubowicz, Z.Orłoś: Wytrzymałość materiałów. Tom 1, WNT, W-wa 2003
7. Z.Dyląg, A.Jakubowicz, Z.Orłoś: Wytrzymałość materiałów. Tom 2, WNT, W-wa 2003
8. M.E.Niezgodziński, T.Niezgodziński, Zadania z wytrzymałości materiałów, WNT, Warszawa, 1997
9. M.Banasiak, K.Grossman, M.Trombski, Zbiór zadań z wytrzymałości materiałów, PWN, 1998

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

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