STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Strenght of Materials**		Code **1010101121010110028**
Field of study **Civil Engineering First-cycle Studies**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **45** Classes: **30** Laboratory: **15** Project/seminars: **30**		No. of credits **9**
Status of the course in the study program (Basic, major, other) **major**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **9 100%** **9 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics and mechanics. Understanding of the concept of derivative and integral, knowledge of matrix algebra. Knowledge of the equilibrium equations and internal forces in beam and frame structures.
2	**Skills**	The ability to calculate derivatives and integrals of functions, the ability to use matrix calculus. Ability to use the equilibrium equations in order to determine the support reactions and internal forces in statically determinated systems.
3	**Social competencies**	Students respect their own and other people's property, including the property of the university. Students can participate in social life of the university. The student follows the rules of ethics.

Assumptions and objectives of the course:

acquire the knowledge, skills and competence in solving problems of stress, strain and displacement in the rod elements of the structure and mechanics of materials

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows basic terms of strength of materials: stress, strain, displacement, axis of inertia and main axes of the cross-section, isotropy, homogeneity - [K_W04, K_W05]
2. Student knows constitutive and geometrical relations, strength hypothesis for linear theory. - [K_W04, K_W05]
3. Student knows basis of experimental methods in strngth of materials. - [K_W04, K_W05]

Skills:

1. Student is able to determine the stress state in the points of the rod cross-section in basic cases of internal forces action. - [K_U04, K_U13]
2. Student is able to determine displacements of the beam structure using equilibrium differential equations. - [K_U04]
3. Student is able to determine the critical load of the axially loaded column. - [K_U11]

Social competencies:

1. Student understands the need for learning; can inspire and organize the process of learning of other people.. - [K_K03, K_K09]
2. Student is able to cooperate in a group accepting different roles in the group. - [K_K01, K_K05]
3. Student is responsible for safety of the own work and work of the team. - [K_K05]

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Assessment methods of study outcomes

- classes are passed in the case of positive marks (at least E) in each from two (or more) tests (duration of each test 90 minutes), dates of tests should be given at the beginning of the semester,
- laboratory classes are passed in the case of positive marks (at least E) in 6 laboratory reports and positive laboratory test mark,
- project classes are passed in the case of positive marks (at least E) in 10 project tasks,
- the subject is finished by a written examination (duration 120 minutes), dates given at the beginning of the semester.

Scale of the evaluation:

excellent (A)

good (B)

average (C)

passing (D)

near failed (E)

failed (F)

Course description

Idealization of structural models: 1D (rod, truss, beam, column, frame, arch, grid), 2D (plate, slab, shell), 3D (block). Actions: loads, temperature. First and second moments of area. Boundary Value Problem of linear elasticity. Internal forces in statically determinated rod structures. State of stress and strain in special cases: axial tension, pure bending, bending with shear force, skew bending, eccentric tension, torsion. Displacements of beams. Elastic energy. Non-linear behavior of materials, plasticity. Equivalent stress measures. Elements of limit load analysis. Stability of a column. Reological phenomena. Stress concentration. Fatigue. Elements of mechanics of thin walled rods. Experimental methods.

Basic bibliography:

1. A. Gawęcki, Mechanika materiałów i konstrukcji prętowych, tomy 1 i 2, Wyd. Pol. Pozn. 19982.
2. A. Garstecki, M. Dębiński, Wytrzymałość materiałów, Podręcznik internetowy, www.ikb.poznan.pl.
3. A. Boruszak, R. Sygulski, K. Wrześniowski, Wytrzymałość materiałów, doświadczalne metody badań, PWN, 1984.

Additional bibliography:

1. S. Piechnik, Wytrzymałość materiałów, Politechnika Krakowska, Kraków 1999
2. A. Jakubowicz, Z. Orłoś, Wytrzymałość Materiałów, tomy 1 i 2, WNT, Warszawa, 1999 i 1997
3. Z. Cywiński, Mechanika budowli w zadaniach. Układy statycznie wyznaczalne, PWN Warszawa 1999
4. S. Timoshenko, Strength of Materials, Krieger Pub Co, 3rd edition, 1983.
5. J. Grabowski, A. Iwanczewska, Zbiór zadań z wytrzymałości materiałów, Oficyna Wydawnicza Politechniki Warszawskiej, 1994.

Result of average student's workload

Activity	Time (working hours)
1. Participation in the lectures	45
2. Participation in the classes	30
3. Participation in the laboratory classes	15
4. Participation in the project classes	30
5. Preparations for laboratory classes	15
6. Reports from laboratory experiments	15
7. Continuation of the projects	60
8. Participation in the consultations	5
9. Exercises before classes tests	25
10. Exercises before projects defense	15
11. Exercises before the final exam and participation in the exam	15

Student's workload

Source of workload	hours	ECTS
Total workload	225	9
Contact hours	130	5
Practical activities	165	4

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