



Subject card

| | | | | | | | |
|---|--|---|-------------------------------------|------------|---------|---------|-----|
| Subject name and code | Strength of Materials, PG_00062069 | | | | | | |
| Field of study | Civil Engineering | | | | | | |
| Date of commencement of studies | October 2023 | Academic year of realisation of subject | 2024/2025 | | | | |
| Education level | first-cycle studies | Subject group | | | | | |
| Mode of study | Full-time studies | Mode of delivery | at the university | | | | |
| Year of study | 2 | Language of instruction | Polish | | | | |
| Semester of study | 3 | ECTS credits | 6.0 | | | | |
| Learning profile | general academic profile | Assessment form | exam | | | | |
| Conducting unit | Katedra Wytrzymałości Materiałów -> Faculty of Civil and Environmental Engineering | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Magdalena Rucka | | | | | |
| | Teachers | dr inż. Marcin Nowak dr inż. Dawid Bruski dr inż. Tomasz Ferenc dr inż. Karol Daszkiewicz dr inż. Łukasz Pachocki dr inż. Aleksandra Kuryłowicz-Cudowska Radosław Wolny dr inż. Marek Jasina dr inż. Erwin Wojtczak mgr inż. Błażej Meronk prof. dr hab. inż. Wojciech Witkowski prof. dr hab. inż. Jacek Chróścielewski prof. dr hab. inż. Magdalena Rucka | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 45.0 | 30.0 | 0.0 | 15.0 | 0.0 | 90 |
| | E-learning hours included: 0.0 | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM | | |
| | Number of study hours | 90 | 0.0 | 0.0 | 90 | | |
| Subject objectives | Determination of stresses, strains and deflections in bar elements Identification of the problems of Strength of Materials Analysis of complex stress states Stability analysis of structural elements Assessment of limit load-carrying capacity of cross-sections of bar elements. | | | | | | |

| | | | |
|---|--|---|---|
| Learning outcomes | Course outcome | Subject outcome | Method of verification |
| | [K6_K03] Can effectively, clearly and unambiguously convey information, describe activities and communicate their results/outcomes to engineers or a wider audience using appropriate communication methods and tools. | The student presents the results of the calculations carried out in an understandable way and gives clear and adequate answers to the questions concerning them. | [SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice |
| | [K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results. | The student solves tasks and design issues. The student prepares a report on the calculations made. | [SU1] Assessment of task fulfilment |
| | [K6_U01] Apply knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering to solve engineering problems and issues. | The student uses knowledge of mathematics, physics, structural statics and strength of materials to solve problems in structural mechanics, including solving computational tasks | [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment |
| | [K6_W05] Demonstrate knowledge and understanding of research methods (obtaining information, simulations, experimental methods) in the field of civil engineering. | The student transforms stresses and strains in plane states. The student determines stresses based on internal forces in bar systems. The student dimensions sections of members due to ultimate and serviceability limit states. The student recognises elastic and plastic/boundary state dimensioning. The student analyses the stability of a structure and its components. | [SW1] Assessment of factual knowledge |
| [K6_W02] Demonstrate knowledge and understanding of the processes and established methods of analysis / solution of engineering issues & problems in the field of civil engineering and of their limitations. | The student has knowledge of structural statics and strength of materials, describes the behaviour of structures under external influences and analyses the extent to which analytical models are valid. The student recognises basic material models and identifies strength cases. | [SW1] Assessment of factual knowledge | |
| Subject contents | Assumptions and the scope of Strength of Materials (SM). Stress and strain - definitions. Plane stress and plane strain. Three-dimensional stress and strain state. Hookes law (constitutive relations). Boundary problem of linear elasticity theory. Classification of problems of Strength of Materials. Axial tension (compression), statically indeterminate cases, stress concentration. Results of laboratory tests of materials: tension/compression. Geometrical parameters of cross-sections. Uniaxial and biaxial bending. Bending with tension/compression, core of the cross-section, eccentric compression with the tension zone excluded. Free torsion of rods. Circular and rectangular cross-sections. Open thin-walled cross-sections, closed thin-walled cross-sections (Bredt formulae). Joints of structural elements. Shear stresses at bending. Open thin-walled cross-sections, shear centre (bending centre). Compound and multiple beams. Composite beams tension/compression, bending. Deflection line of a beam. Eulers equation, integration methods. Moment-area method (Mohrs method). Redundant cases. Potential energy of elastic strain. Clapeyrons theorem. Unit energy of elastic strain (shear, compression, bending, torsion). Castiglianos theorems calculating deflections (beams, frames, trusses), graphical integration. Stability of beams. Elastic and inelastic buckling. Design of axially compressed beams. Beams on elastic foundation, Winklers hypothesis. Strength criteria, equivalent stresses. Elements of plasticity theory. Material models. Limit load-carrying capacity of a cross-section (axial tension/compression, bending, tension/compression with bending). Plasticity zones of a beam. Cables. Stresses perpendicular to the beam axis under bending. Curvilinear beams, tension/compression, bending. Elements of rheology, time-dependent material models. Results of laboratory tests of materials: creep, relaxation and fatigue tests. Restrained torsion of open-shaped thin-walled cross-sections. | | |
| Prerequisites and co-requisites | Course Engineering Mechanics should be completed. Course Experimental Methods in Strength of Materials should be taken. | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Project tasks | 60.0% | 20.0% |
| | Written exam | 60.0% | 80.0% |

| | | |
|--|---|---|
| Recommended reading | Basic literature | <p>Bielewicz E.: Wytrzymałość materiałów. Politechnika Gdańska, Gdańsk 1968, 1972, 1977, 1980, 1984, 2001, 2006.</p> <p>Szymczak Cz., Skowronek M., Witkowski W., Kujawa M.: Wytrzymałość materiałów. Zadania. PG, Gdańsk 2002, 2009.</p> <p>Dyląg Z., Jakubowicz A., Orłós Z.: Wytrzymałość materiałów, tom I, Wydawnictwa Naukowo-Techniczne, 2003.</p> <p>Chróścielewski J.: Materiały pomocnicze do wykładu z Wytrzymałości Materiałów (na portalu eNauczanie).</p> |
| | Supplementary literature | <p>Piechnik S.: Wytrzymałość materiałów, podręcznik dla studentów wyższych szkół technicznych. PK, Kraków 2000.</p> <p>Jastrzębski P., Mutermilch J., Orłowski W.: Wytrzymałość materiałów. Arkady, Warszawa 1974.</p> <p>Orłowski W., Słowiński L.: Wytrzymałość materiałów, przykłady obliczeń. Arkady, Warszawa 1978.</p> <p>Jakubowicz A., Orłós Z.: Wytrzymałość materiałów. WNT, Warszawa 1968.</p> <p>Magnucki K., Szyc W.: Wytrzymałość materiałów w zadaniach, PWN, Warszawa-Poznań 1987.</p> <p>Dyląg Z., Jakubowicz A., Orłós Z.: Wytrzymałość materiałów, tom II, Wydawnictwa Naukowo-Techniczne, 2003.</p> |
| | eResources addresses | Adresy na platformie eNauczanie: |
| Example issues/ example questions/ tasks being completed | <p>Determine axial forces in a truss / truss-frame system, determine stresses and deflections.</p> <p>Draw the normal stress diagram at a cross-section of a beam at bending, determine the allowable load due to elastic load-carrying capacity.</p> <p>Determine buckling load of a bar, given boundary conditions and a cross-section, perform the elastic buckling check.</p> | |
| Work placement | Not applicable | |

Document generated electronically. Does not require a seal or signature.