

## COURSE INFORMATION SHEET (Karta informacyjna przedmiotu)

Course title (Nazwa przedmiotu)	<i>Strength of materials 2</i>	<i>Wytrzymałość materiałów 2</i>
Course code (Kod przedmiotu)	WMEMXCSI-23Z1-SM2	
Language of instruction (Język wykładowy)	<i>English (angielski)</i>	
Study profile (Profil studiów)	<i>General academic (ogólnoakademicki)</i>	
Study form (Forma studiów)	<i>Full time studies (stacjonarne)</i>	
Study level (Poziom studiów)	<i>First-cycle studies (studia pierwszego stopnia)</i>	
Course group (Rodzaj przedmiotu)	<i>Core/mandatory (podstawowy/obowiązkowy)</i>	
Effective from recruitment (Obowiązuje od naboru)	2023/2024	
Form of classes, no. of hours/evaluation, total no. of hours, ECTS credits (Forma zajęć, liczba godzin/rygor, razem godz., pkt ECTS)	<i>Lectures: 16h, (Wykłady: 16h)</i> <i>Practical classes: 20h, (Ćwiczenia: 20h)</i> <i>Laboratory excercises: 6h (Laboratoria: 6h)</i> <i>Total: 42hrs, (Razem: 42h)</i> <i>3,0 ECTS, (3,0 pkt ECTS)</i>	
Introductory courses: prerequisites (Przedmioty wprowadzające: wymagania wstępne)	<b><i>Mathematics:</i></b> vectors; differential equations; derivatives and integrals of one variable. <b><i>Engineering mechanics 1:</i></b> 2D modeling, 3D modeling, reduction and balance of load systems, determination of reactions. <b><i>Strength of Materials 1:</i></b> geometrical properties of planar figures, internal forces in bars, beams, plane and spatial frames, fundamentals of the strength of materials, tension and compression of prismatic stocky bars, torsion of bars	
Programme (Program)	<i>4th semester / Mechanics and machine construction / all specializations</i>	
Autor(s) (Autor/autorzy)	<i>dr inż. Roman GIELETA</i>	
Organizational unit administering the course (Jednostka organizacyjna odpowiedzialna za przedmiot)	<i>Institute of Mechanics and Computational Engineering</i> <i>Faculty of Mechanical Engineering</i> <i>Military University of Technology</i>	
Short description of the course (Skrócony opis przedmiotu)	Bending and shear stresses. Spatial and plane states of stress. Spatial and plane states of strain. Hooke's law for an isotropic material. Failure theories for an isotropic material. Combined loadings. Displacements in simple beams and plane frames using the method of virtual work (the Maxwell-Mohr method). Statically indeterminate beams and plane frames - force method. Buckling of straight slender bars.	

<p>Full description of the course / programme content (Pełny opis przedmiotu / treści programowe)</p>	<p><i>Lectures / multimedia presentations</i></p> <ol style="list-style-type: none"> <li>1) Bending and shear stresses / 2 h</li> <li>2) Spatial and plane states of stress / 1 h</li> <li>3) Spatial and plane states of strain / 1 h</li> <li>4) Hooke's law for an isotropic material / 1 h</li> <li>5) Failure theories for an isotropic material / 1 h</li> <li>6) Combined loadings / 2 h</li> <li>7) Displacements in simple beams and plane frames using the method of virtual work (the Maxwell-Mohr method) / 4 h</li> <li>8) Statically indeterminate beams and plane frames - force method / 2 h</li> <li>9) Buckling of straight slender bars / 2 h</li> </ol> <p><i>Practical classes</i></p> <ol style="list-style-type: none"> <li>1) Bending and shear stresses / 3</li> <li>2) Spatial and plane states of stress / 1 h</li> <li>3) Spatial and plane states of strain / 1 h</li> <li>4) Hooke's law for an isotropic material / 1 h</li> <li>5) Failure theories for an isotropic material / 1 h</li> <li>6) Combined loadings / 1 h</li> <li>7) Displacements in simple beams and plane frames using the method of virtual work (the Maxwell-Mohr method) / 3</li> <li>8) Statically indeterminate beams and plane frames - force method / 3</li> </ol> <p>Test 1: Bending and shear stresses / 2  Test 2: Displacements in simple beams and plane frames using the method of virtual work (the Maxwell-Mohr method) / 2  Test 3: Statically indeterminate beams and plane frames - force method / 2</p> <p><i>Laboratory excercises</i></p> <ol style="list-style-type: none"> <li>1) Static tensile test of metals. Strict tensile testing of metals. Static compression test of metals. / 2</li> <li>2) Determination of shear modulus. Torsion of a bar with a rectangular cross-section. Experimental checking of Maxwell's theorem. Experimental checking of the beam deflection formula. / 2</li> <li>3) Elastic buckling of a compressed member. Determination of stresses in a bending beam using the strain gauge method. / 2</li> </ol>
<p>Literature (Literatura)</p>	<p><i>Primary:</i>  M. Klasztorny, <i>Wytrzymałość materiałów dla mechaników. Kurs inżynierski, DWE, 2013</i>  Gieleta R., <i>Wytrzymałość materiałów. Zbiór zadań z rozwiązaniami, WAT, 2018.</i>  Z. Dyląg, A. Jakubowicz, Z. Orłó: <i>Wytrzymałość materiałów, T. 1, WNT, 1997</i>  R. Bąk, T. Burczyński: <i>Wytrzymałość materiałów z elementami ujęcia komputerowego, WNT, 2001</i>  M.E. Niezgodziński, T. Niezgodziński: <i>Zadania z wytrzymałości materiałów, WNT, 2000</i>  M. Bijak-Żuchowski, A. Jaworski, G. Krzesiński, T. Zagrajek: <i>Wytrzymałość konstrukcji, OW PW, 2004</i>  K. Gołoś, J. Osiński: <i>Zbiór zadań z wytrzymałości materiałów, OW PW, 2001</i></p> <p><i>Complementary:</i>  –</p>
<p>Learning outcomes (Efekty uczenia się)</p>	<p><i>Symbol and number of the course outcome /learning outcomes /reference to the major outcome</i></p> <p>W1 / has knowledge of the strength of materials, including simple bending of beams, combined loadings in bars, states of stress and strain, application of the principle of virtual work to determine displacements, the force method, buckling of slender bars / K_W01, K_W02, K_W05</p> <p>U1 / is able to solve simple strength problems in the field of simple bending of beams, combined loadings in bars, the application of the principle of virtual</p>

	<p>work to determine displacements, the force method, based on the principles of strength of materials / K_U07, K_U09  K1 / understands the need and knows the possibilities of continuous education; can inspire and organize the process of improving own's and other people professional qualifications / K_K01</p>
<p>Methods and criteria of evaluation I manners of verification the student's achievement of the assumed learning outcomes (Metody i kryteria oceniania / sposób sprawdzania osiągnięcia przez studenta zakładanych efektów uczenia się)</p>	<p>The course is credited based on: <b>final exam</b>.  Practical classes are credited based on: <b>tests and homeworks</b>.  Laboratory exercises are passed on the basis of: <b>tests of theoretical knowledge and reports</b>.  The condition for admission to the final exam is: <b>passing the practical classes and laboratory exercises</b>.  The final exam is conducted in a written form and includes a practical part (problem solving) and a theoretical part.  The grade in the exam is independent of the grade in the practical classes and laboratory exercises.  The achievement of W1 learning outcome is verified based on the theoretical part of the final exam.  The achievement of U1 learning outcome is verified based on the practical part of the exam, tests during practical classes and homeworks.  The achievement of K1 learning outcome is effected based on students' activity.  Assessment of the achieved learning outcomes (according to opinion of the Faculty Commission for the Functioning of the Education Quality Assurance System):  <b>Very good (A)</b> - grade awarded to students who achieved 91-100% of the learning outcomes.  <b>Good plus (B)</b> - grade awarded to students who achieved 81-90% of the learning outcomes.  <b>Good (C)</b> - grade awarded to students who achieved 71-80% of the learning outcomes.  <b>Satisfactory plus (D)</b> - grade awarded to students who achieved 61-70% of the learning outcomes.  <b>Satisfactory (E)</b> - grade awarded to students who achieved 51-60% of the learning outcomes.  <b>Unsatisfactory (F)</b> - grade awarded to students who achieved 50% of the learning outcomes or less   <b>PASS</b> - grade awarded to students who achieved more than 50% of the learning outcomes.  <b>FAIL</b> - grade awarded to students who achieved 50% of the learning outcomes or less</p>
<p>ECTS balance / student workload  (Bilans ECTS / nakład pracy studenta)</p>	<p>Activity / student workload in hrs  1. Participation in lectures / 16  2. Participation in practical classes / 20  3. Participation in laboratories / 6  4. Participation in seminars / 0  5. Independent study of the lectures subject-matter/ 12  6. Independent preparation for practical classes / 20  7. Independent preparation for laboratories / 6  8. Independent preparation for seminars / 0  9. Project implementation / 0  10. Participation in consultations / 4  11. Preparation for the exam / 10  12. Preparation for the credit / 0  13. Participation in the exam / 2  Total student workload:  <b>96 hrs /3.2 ECTS, 3.0 ECTS assumed</b>  Classes with academic teacher (1+2+3+4+9+10+13): 48 hrs / 1.5 ECTS  Classes related to scientific skill development (<math>\Sigma</math>1+9): 80 hrs / 2 ECTS</p>