SYLLABUS

Course description

<table>
<tr><td colspan="2">Course code</td><td rowspan="2">Course</td><td colspan="4">MECHANIKA KONSTRUKCJI</td></tr>
<tr><td colspan="2">MB/O/I/ST/C1A.4</td><td colspan="4">MECHANICS OF STRUCTURES</td></tr>
<tr><td colspan="3">Language of instruction</td><td colspan="4">English</td></tr>
<tr><td colspan="3">Academic year</td><td colspan="4">2023/2024</td></tr>
<tr><td colspan="3">field of study:</td><td colspan="4">Mechanical engineering</td></tr>
<tr><td colspan="3">field of specialisation:</td><td colspan="4">CAE</td></tr>
<tr><td colspan="3">Educational level</td><td colspan="4">first-cycle studies</td></tr>
<tr><td colspan="3">Education profile</td><td colspan="4">General academic</td></tr>
<tr><td colspan="3">Mode of study</td><td colspan="4">Full-time studies</td></tr>
<tr><td colspan="3">Semester(s)</td><td colspan="4">5</td></tr>
<tr><td colspan="3">Affiliation with a group of classes</td><td colspan="4">Specialization module</td></tr>
<tr><td colspan="3">Course status</td><td colspan="4">Obligatory</td></tr>
<tr><td colspan="3" rowspan="4">Types of classes, instruction hours, ECTS credits</td><td>Types of classes</td><td>Number of instruction hours</td><td colspan="2">Number of ECTS credits</td></tr>
<tr><td>Lecture</td><td>30 [h]</td><td colspan="2" rowspan="3">5 ECTS</td></tr>
<tr><td>Classes</td><td>30 [h]</td></tr>
<tr><td>Laboratories</td><td>15 [h]</td></tr>
<tr><td rowspan="3">Linkage of the course</td><td>with the education profile</td><td colspan="3">The course is related to the conducted research in the scope of design and analysis of the supporting structures of machines and transport devices.</td><td>5 ECTS</td></tr>
<tr><td>with qualifications</td><td colspan="3">The aim of the course is to develop students engineering skills.</td><td>5 ECTS</td></tr>
<tr><td>with science discipline</td><td colspan="3">Mechanical engineering</td><td>5 ECTS</td></tr>
<tr><td colspan="3">Form of teaching</td><td colspan="4">Traditional – classes organized at the University /classes conducted using online learning methods and techniques</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="4">Mathematics, Mechanical Engineering, Strength of materials</td></tr>
<tr><td colspan="3">Department</td><td colspan="4">Faculty of Mechanical Engineering</td></tr>
<tr><td colspan="3">Coordinator</td><td colspan="4">dr inż. Roman Król</td></tr>
<tr><td colspan="3">The website of the basic organizational unit</td><td colspan="4">www.wm.uniwersytetradom.pl</td></tr>
<tr><td colspan="3">E-mail address, phone number of the coordinator</td><td colspan="4">r.krol@uthrad.pl phone: 361-71-12</td></tr>
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LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	C1 – Ability to perform strength analysis of the constructions which consists of rods under complex loading state including statically indeterminate constructions C2 – to familiarize Students with the basics of the plate, pipe and thin walled vessels analysis C3 – to develop skills in performing the fatigue life computations and analysis of the structures in the scope of elasto-plastic deformations
Curriculum Content:	Lecture: Solving beam diagrams of the statically determinate structures under tension or under bending. Analysis of statically determinate frames. Solving displacements in the statically determinate frames. The Reciprocal Theorem. The superposition method. Energy methods in solving reaction forces and displacements in statically indeterminate beam and frames. Castigliano's Theorem and Menabrea's Theorem. Using Maxwell-Mohr equations and Vereshchagin's Method in solving statically indeterminate reaction forces and reaction moments. Beam diagrams for the statically indeterminate structures. Analysis of the beam deflection line using Clebsch's Method. Analysis of thin-walled vessels. Exercises: Solving complex strength of materials problems concerning statically determinate supporting structures. Solving beam diagrams with internal moments and internal forces of the statically determinate frames. Solving axial stress distribution in the rod structures. Analysis of the statically indeterminate beams using Maxwell-Mohr equations. Solving statically indeterminate reaction forces and reaction moments using Menabrea's Theorem. Solving problems with energy methods. Determining the beam deflection line using Clebsch's Method. Application of the symbolic calculations in the MATLAB environment in the solution of the exercises with the energy methods. Laboratory exercises: Verification of the Strength of Materials' theorems and methods: the Reciprocal Theorem, Vereshchagin's Method. Verification of the statically indeterminate reaction forces and reaction moments solved by the Finite Element Method using Autodesk Nastran In-CAD software and by the theoretical calculations according to Menabrea's Theorem. Verification of the FEA analysis of structures using energy methods. Solving displacements of the statically indeterminate frames on the basis of the beam diagrams obtained as a result of the FEA analysis.
Didactic (educational) methods:	traditional
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	Lecture – rating from the test Exercises – average grade on the basis of test and homework problems Laboratory exercise – laboratory reports grade

Learning outcomes for the course in relation to the field of study learning outcomes and the type of classes				Methods of verifying learning outcomes	
Learning outcome number	Description of the learning outcomes for the course (PEU) A student who has passed the course (**W**) knows and understands / (**U**) can / (**K**) is ready to:	Field of study learning outcome (KEU)	Types of classes	Form of verification (credits)	Methods of testing and assessment
W1	Student has the knowledge, how to use energy methods in truss structures	K_WG05 K_WG06	Laboratory/ Classes/ Lectures	Reports, tests, problems, examination	
W2	Student knows the term "stress concentration" and can solve fatigue life of the structure	K_WG11	Classes/ Lectures	Test, problems, examination	
W3	Student has basic knowledge about simple load cases in mechanical structures in the range of elastic deformation (bending, torsion, tension)	K_WG06 K_WG11	Classes/ Lectures	Test, problems, examination	
W4	Student has knowledge, which allow him to estimate safety of the mechanical structures	K_WG06	Classes/ Lectures	Test, problems, examination	
U1	Student can solve beam diagrams in the truss structure, can solve stresses and displacements	K_UW02	Laboratory/ Classes/ Lectures	Reports, tests, problems, examination	
U2	Student can compose substitute diagram for the statically indeterminate truss structures and can solve the reaction forces	K_UW02	Laboratory/ Classes/ Lectures	Reports, test, problems, examination	
U3	Student can apply strength hypotheses and can estimate safety of the mechanical structure	K_UW10 K_UW11 K_UW14	Laboratory/ Classes/ Lectures	Test, problems, examination	
K1	Student can cooperate and work in group and understand other than technical aspects of engineering	K_UO20 K_KO03	Laboratory/ Classes/ Lectures	Verbal assessment	Verbal assessment

Literature and teaching aids
1.M. Bijak-Żochowski, A.Jaworski, G.Krzesiński, T. Zagrajek: Wytrzymałość konstrukcji. OWPW,Warszawa, 2004. 2.R. Bąk, T. Burczyński: Wytrzymałość materiałów z elementami ujęcia komputerowego. WNT, Warszawa, 2001. 3. Brzoska Z., Wytrzymałość materiałów, PWN, Warszawa, 1983. 4. Niezgodziński M. E., Niezgodziński T., Wytrzymałość materiałów, PWN, Warszawa, 2002. 5. Niezgodziński M. E., Niezgodziński T., Wzory wykresy i tablice wytrzymałościowe, WNT, Warszawa, 1996.

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits			
Attendance, participation	Student workload [h].		
	Other contact hours (IGK)	Student's self-study hours Classes without a teacher (ZBN**)**	Classes
Participation in ... lectures	X	X	30 [h]
Participation in .... classes/laboratory classes	X	X	30 [h]
Participation in …. laboratories	X	X	15 [h]
Meeting with teachers during their duty hours	2 [h]	X	X
Preparation for lectures/classes/.... , Preparation for ... credit / exam	X	48 [h]	X
Total student workload	2[h]/ 0,1 ECTS	48 [h]/1.9 ECTS	75[h]/ 3 ECTS

ECTS credits for the course	5 ECTS

Additional information, comments
In the case of students with special needs, including disabilities, and chronic illnesses, the methods and forms of verification of learning outcomes specified above (in the syllabus) are adapted to the individual needs of these students, as appropriate. Detailed rules and forms of support for students with special needs, including those with disabilities and chronically ill, during classes, credits, and exams are specified in: University Regulations (Regulamin Studiów Uniwersytetu Technologiczno-Humanistycznego w Radomiu), Study Regulations (Zasady Studiowania), and Procedure for Ensuring Accessibility of the Educational Process to Students with Special Needs, Including Those with Disabilities and Chronically ill (Procedura dotycząca zapewnienia dostępności procesu kształcenia studentom ze szczególnymi potrzebami, w tym: z niepełnosprawnością, przewlekle chorych).