SYLLABUS

Course description

<table>
<tr><td colspan="2">Course code</td><td rowspan="2">Course</td><td colspan="4">KOMPUTEROWA ANALIZA KONSTRUKCJI</td></tr>
<tr><td colspan="2">MB/O/I/NST/C1A.10</td><td colspan="4">COMPUTER ANALYSIS 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 Computer Aided Engineering</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">Part-time studies</td></tr>
<tr><td colspan="3">Semester(s)</td><td colspan="4">6</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>8 [h]</td><td colspan="2" rowspan="3">3 ECTS</td></tr>
<tr><td>Classes</td><td>16 [h]</td></tr>
<tr><td>…</td><td>…</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 analysis and design of supporting structures of machines and transport devices</td><td>3 ECTS</td></tr>
<tr><td>with qualifications</td><td colspan="3">The aim of the course is to gain the engineering skills by students</td><td>3 ECTS</td></tr>
<tr><td>with science discipline</td><td colspan="3">Mechanical engineering</td><td>3 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">Knowledge concerning “Strength of materials”, “Mechanical Vibration” and “Basics of the Finite Element Method”</td></tr>
<tr><td colspan="3">Department</td><td colspan="4">Department of Applied Mechanics and Mechatronics, UTH Radom</td></tr>
<tr><td colspan="3">Coordinator</td><td colspan="4">dr hab. inż. Kazimierz Król, prof. UTH</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">k.krol@uthrad.pl, tel. (48) 361 71 11</td></tr>
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LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	C1 – developing skills of beam and truss structures finite element model preparation, definition of a boundary conditions, running the multicriteria sensitivity analysis of structures loaded by the point forces, pressure, heat flux or coming into contact with other bodies. C2 – development of verification skills in a model of mechanical structure and the abilities to relevant modification of a model
Curriculum Content:	The course curriculum is related to the conducted research, completed research projects and commissioned technical expertise. Lectures curriculum: Review of the basic "Strength of materials", "Finite Element Method" and "Mechanics of structures" laws and theorems. Methods of Computer Aided Engineering in the analysis of structures. Methods of the model discretization and mesh design. Setting up boundary conditions. Using strength hypotheses to estimate stress, strain and safety factor in the structures and estimation of the structure compliance relative to the applied load. Managing loading cases. Verification of the analysis results and introduction of the simplification in the theoretical models. Sensitivity of the structure on the changes in a geometry and boundary conditions. Finding and elimination of analysis faults. Classes curriculum: Import of the geometry prepared in the CAD software to the Finite Element Software. Design of the truss and beam structures in the Finite Element Software. Design of the finite element mesh. Setting up boundary conditions. Strength analysis of the supporting structures on the example of multi-section crane beam, cantilever and 3D frames. Strength analysis of constructions meshed with brick finite elements. Analysis of results and verification. Control of the numerical model using auxiliary parameters (volume, mass, curvature, centre of mass, moments of inertia). Improvement in the model discretization and geometry to eliminate stress concentration or modify nominal stress.
Didactic (educational) methods:	- Exercise method (lecture with problems to solve, conversational lecture) - Methods exposing structure analysis cases - Programming methods (using personal computer) - Practical methods (traditional problem solving exercises, numerical simulation of the stresses and strains)
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	The condition for passing a subject is to achieve all the required learning outcomes specified for a given subject. Obtaining positive grades in all forms of classes included in a given subject is tantamount to obtaining positive grades with its completion and obtaining by the student the number of ECTS points assigned to this subject. How to calculate the final grade in the subject is specified in the study regulations.

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 knowledge in the field of truss and beam structure models preparation and their static and dynamic analysis (including strength analysis)	K_WG06	Lectures/ Project	Project/ Test	

U1	Student can use professional engineering software for preparation of the truss and beam structure models and can perform analysis with results verification	K_UW05 K_UW13	Lectures/ Project	Project/ Test	
K1	Student know about the social role of engineer especially in the scope of mechanics, machine design and calculation	K_KR06	Lectures/ Project	Project/ Test	

Literature and teaching aids
1. Rakowski G., Kacprzyk Z.: Metoda Elementów Skończonych w mechanice konstrukcji. Oficyna Wydawnicza PW., Warszawa, 2005. 2. Zienkiewicz O. C., Taylor R. L., The Finite Element Method , I: The Basis. Butterworth-Heinemann, Oxford, 2000. 3.K. Król, M. Wikło: Dziesięć ćwiczeń laboratoryjnych z drgań mechanicznych. Politechnika Radomska, 2012. 4.K. Król: Metoda elementów skończonych w obliczeniach konstrukcji. Politechnika Radomska, 2006. 4.Przykłady z prac badawczych wykonanych w Katedrze Mechaniki Stosowanej i Mechatroniki, UTH Radom. 5. Programy graficzne 3D oraz program realizujące analizy wytrzymałościowe metodą elementów skończonych

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	8 [h]
Participation in .... classes/laboratory classes	X	X	16 [h]
Meeting with teachers during their duty hours	8 [h]	X	X
Preparation for lectures/classes/.... , Preparation for ... credit / exam	X	43 [h]	X
Total student workload	8[h]/ 0,3 ECTS	43 [h]/1,8 ECTS	24[h]/ 0,9 ECTS
ECTS credits for the course	3 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).