SYLLABUS

Course description

<table>
<tr><td colspan="2">Course code</td><td rowspan="2">Course</td><td colspan="4">KINEMATYKA I DYNAMIKA UKŁADÓW WIELOCZŁONOWYCH</td></tr>
<tr><td colspan="2">MB/O/I/ST/C1A.3</td><td colspan="4">KINEMATICS AND DYNAMICS OF MULTIBODY SYSTEMS</td></tr>
<tr><td colspan="2">Language of instruction</td><td colspan="5">English</td></tr>
<tr><td colspan="2">Academic year</td><td colspan="5">2023/2024</td></tr>
<tr><td colspan="2">field of study:</td><td colspan="5">Mechanical Engineering</td></tr>
<tr><td colspan="2">field of specialisation:</td><td colspan="5">Computer Aided Engineering</td></tr>
<tr><td colspan="2">Educational level</td><td colspan="5">first-cycle studies</td></tr>
<tr><td colspan="2">Education profile</td><td colspan="5">general academic</td></tr>
<tr><td colspan="2">Mode of study</td><td colspan="5">Full-time studies</td></tr>
<tr><td colspan="2">Semester(s)</td><td colspan="5">5</td></tr>
<tr><td colspan="2">Affiliation with a group of classes</td><td colspan="5">Specialization module</td></tr>
<tr><td colspan="2">Course status</td><td colspan="5">obligatory</td></tr>
<tr><td colspan="2" rowspan="3">Types of classes, instruction hours, ECTS credits</td><td colspan="2">Types of classes</td><td>Number of instruction hours</td><td colspan="2">Number of ECTS credits</td></tr>
<tr><td colspan="2">Lecture</td><td>15 [h]</td><td colspan="2" rowspan="2">3 ECTS</td></tr>
<tr><td colspan="2">Laboratory</td><td>30 [h]</td></tr>
<tr><td rowspan="3">Linkage of the course</td><td>with the education profile</td><td colspan="4">the subject is related to the research activity in the discipline to which the course of study is assigned</td><td>3 ECTS</td></tr>
<tr><td>with qualifications</td><td colspan="4">the subject is used to acquire engineering competences by the student</td><td>3 ECTS</td></tr>
<tr><td>with science discipline</td><td colspan="4">mechanical engineering</td><td>3 ECTS</td></tr>
<tr><td colspan="2">Form of teaching</td><td colspan="5">Traditional – classes organized at the University /classes conducted using distance learning methods and techniques</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="5">Mathematics, numerical methods, engineering mechanics</td></tr>
<tr><td colspan="2">Department</td><td colspan="5">Faculty of Mechanical Engineering</td></tr>
<tr><td colspan="2">Coordinator</td><td colspan="5">Kołodziejczyk Krzysztof, PhD</td></tr>
<tr><td colspan="2">The website of the basic organizational unit</td><td colspan="5">www.wm.uniwersytetradom.pl</td></tr>
<tr><td colspan="2">E-mail address, phone number of the coordinator</td><td colspan="5">e-mail: k.kolodziejczyk@uthrad.pl; phone: 483617116</td></tr>
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LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	The aim of the course covers essential elements of kinematics and dynamics of rigid bodies with application to multibody systems. The course to offer a balanced coverage of theoretical aspects and computational methods for modelling and analysis of multibody mechanical systems
Curriculum Content:	**Lecture:** Basic concepts. The structure of mechanisms. Kinematic pairs. Mobility and degrees of freedom. Classification of mechanisms. Planar mechanisms. Modeling of selected kinematic pairs. Problems of kinematics and dynamics. Kinematic and dynamic analysis of mechanisms and planar manipulators (multibody systems). Methods of modeling mechanical systems using different coordinates. Kinematics and dynamics of mechanical systems in CAD/CAE programs SolidWorks Motion, Ansys and Matlab Simulink/Simscape **Laboratory class:** 1. Modeling and simulation of open and closed mechanical systems using differential equations (ODE) and differential-algebraic equations (DAE) 2. Modeling and simulation of mechanical systems using CAD/CAE software – kinematic and dynamic analysis of systems with open and closed structures in SolidWorks Motion, Ansys and in the Matlab/Simulink/Simscape environment. 3. Comparison and interpretation of simulation results obtained with different methods and programs
Didactic (educational) methods:	Conventional lecture using audiovisual means. Laboratory classes conducted at the University on computers. Students work individually or in groups, performing exercises corresponding to the content of lecture
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 obtain 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 passing it and obtaining by the student the number of ECTS points assigned to this subject (Laboratory – raports, lecture – test) The method of calculating the final grade for the course 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 modeling of rigid multibody mechanical systems and methods of solving kinematic and dynamic problems such systems	K_WG01 K_WG05 K_WG17	lecture	Final grade	Test
U1	Student is able with use of computer system and CAD/CAE software to prepare model of mechanical system, perform kinematic and dynamic analysis of the mechanical system and interpret the obtained simulation results	K_UW01 K_UW02 K_UK13 K_UO17	laboratory	Final grade	Raports
K1	Student can cooperate and work in a group	K_UO20	laboratory	Raports	Verbal evaluation

K2	Student can demonstrate creativity in activities related to the implementation of professional tasks	K_KK02 K_KO05	Lecture, laboratory	Verbal evaluation	Verbal evaluation

Literature and teaching aids
1. Parviz E. Nikrevesh, Planar multibody dynamics: Formulation, Programming and Application, CRC Press, 2. Kuang-Hua Chang, Motion Simulation and Mechanism Design with Solidworks Motion 3. Learning materials and instructions received from the teacher

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	15 [h]
Participation in laboratory classes	X	X	30 [h]
Meeting with teachers during their duty hours	2 [h]	X	X
Preparation for lectures/classes Preparation for credit	X	5 [h]/ 18 [h] 5 [h]	X
Total student workload	2 [h]/ 0,1 ECTS	28 [h]/ 1.1 ECTS	45 [h]/ 1.8 ECTS
ECTS credits for the course	75 [h] / 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).