SYLLABUS

Course description

<table>
<tr><td colspan="2">Course code</td><td rowspan="2">Course</td><td colspan="4">DRGANIA MECHANICZNE</td></tr>
<tr><td colspan="2">MB/O/I/NST/C1A.5</td><td colspan="4">MECHANICAL VIBRATION</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">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="3">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>16 [h]</td><td colspan="2" rowspan="2">4 ECTS</td></tr>
<tr><td>Project</td><td>16 [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 analysis and design of supporting structures of machines and transport devices</td><td>4 ECTS</td></tr>
<tr><td>with qualifications</td><td colspan="3">The aim of the course is development of student engineering skills</td><td>4 ECTS</td></tr>
<tr><td>with science discipline</td><td colspan="3">Mechanical engineering</td><td>4 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">Technical Mechanics (dynamics), Strength of materials (solving structure compliance), Mathematics (Ordinary Differential Equations)</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 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 – development of the skills in building mathematical and physical models of the vibrating objects and their analysis C2 – revealing the vibration phenomenon, methods of the calculation of dampers physical parameters, solving natural frequencies and natural modes C3 – development of the skills in proper recognition of vibration sources and causes and their influence on the human and environment
Curriculum Content:	The course curriculum is related to the conducted research, completed research tasks and commissioned technical expertise. Lectures curriculum: Introductory topics. Definition of the vibration. Vibration in the nature and technology. Distinguishing between vibration causes. Vibration damping and excitation. Vibration influence on the human body. Dynamic individuality of the vibrating system. Classification of vibration and vibration systems. Vibration of a linear systems with single degree of freedom. Oscillating movement. Composition of oscillating movements. Lissajous figures. Substitute systems. Degrees of freedom. Body coordinates. Natural vibration without damping. Lagrange-Dirichlet theorem. Natural vibration with a viscous damping. Critical damping. Natural vibration with dry friction damping. Vibration impact damping. Studies and interpretation of vibration on a phase plane. Vibration with complex formulation. Excited vibration in a system with one degree of freedom. Excitation with the oscillating force, periodic non-oscillating force, kinematic and inertial excitation. Resonance graph. Phase-frequency graph. Passing through the resonance zone. Vibration of the linear systems with finite number of degrees of freedom. Classes curriculum: Dynamic models of machines and structures. Design of physical and mathematical models for the vibrating objects with single degree of freedom. Formulation of the system of equations describing oscillating motion. Using d'Alembert rule and the Lagrange equations of second type in formulation of the motion equations of the vibration systems with finite number of degrees of freedom. Selection of the formulation method of the differential equations of motion. Comparison of vibration damping methods. The effect of dynamical isolation. Antiresonance and resonance phenomenon. The methods of excitation and sustaining vibration. Examples: solution of the natural frequencies and natural modes in the systems with 2 or 3 degrees of freedom.
Didactic (educational) methods:	-problem methods (problem lectures, searching for the movies for the presentation of the lecture topics) -traditional, informational lecture, classes with solving tasks -practical methods (classes with laboratory set ups, numerical simulation of the vibration)
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	The condition for passing the course is to achieve all of the required learning outcomes, specified for the subject. Lecture – grade obtained from written control papers (two control papers) and activity in class included during the exam. Project – evaluation for the project or for the modernization of laboratory set ups.

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 can present the kinds of discrete systems vibration and their application in engineering computations. Student knows, how vibration affect an environment and human body. Student has basic knowledge about the numerical methods.	K_WG01 K_WG02 K_WG05 K_WG17	Lecture	Examination	Written examination
U1	Student can compose ordinary differential equations of the natural vibration and excited vibration of the discrete systems, solve natural frequencies and natural modes, building simple laboratory stands for presentation of the vibration, solve responses to a kinematic, inertial and oscillatory force excitations. Student can solve ordinary differential equations using numerical methods.	K_UW08 K_UW09 K_UK14 K_UK16 K_UO17	Lecture/ Project	Examination/ Performing Projects and tasks	Writing tests/ Writing examination/ Checking relevance of the performed laboratory stands
K1	Student can cooperate and work in group and understands other than technical aspects of engineering work including influence on the environment. Student shows creativity in the process of design simple laboratory set ups.	K_KK01 K_KO02 K_KO04	Lecture/ Project	Verbal assessment	Verbal assessment

Literature and teaching aids
1. Daniel J. Inman: Engineering vibrations, Pearson International Edition, 2009. 2. Singiresu S. Rao: Mechanical Vibrations, Pearson 2004, 2011, 2017. 3. K. Król, M. Wikło: Dziesięć ćwiczeń laboratoryjnych z drgań mechanicznych, UTH Radom, 2013. 4. Osiński Z., Teoria drgań, PWN, Warszawa, 1978. 5. Arczewski K., Pietrucha J., Szuster J. T., Drgania układów fizycznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2008.

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	16 [h]
Participation in .... classes/laboratory classes	X	X	16 [h]
Meeting with teachers during their duty hours	2 [h]	X	X
Preparation for lectures/classes/.... , Preparation for ... credit / exam	X	66 [h]	X
Total student workload	2[h]/ 0,1 ECTS	66 [h]/2,6 ECTS	32[h]/ 1,3 ECTS
ECTS credits for the course	4 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).