SYLLABUS

Course description

Course code	Course	Dynamika Maszyn	
B12_ME_O_I_NST		Machine dynamics	
Language of instruction		English	
Academic year		2025/2026	
field of study:		Mechanical Engineering	
field of specialisation:		All	
Educational level		first-cycle studies	
Education profile		General academic	
Mode of study		Part-time studies	
Semester(s)		4	
Affiliation with a group of classes		B. Group of obligatory course core subject	
Course status		Obligatory	
Types of classes, instruction hours, ECTS credits		Types of classes	Number of instruction hours / Number of ECTS credits
		Lecture	15 [h] / 4 ECTS
		Classes	0 [h]
		Lab	30 [h]
Linkage of the course	with the education profile	Related to the conducted scientific activity in the discipline to which the field of study is assigned	4 ECTS
	with qualifications	It is used to acquire engineering competences by the student	4 ECTS
	with science discipline	Mechanical engineering	4 ECTS
Form of teaching		Traditional – classes organized at the University /classes conducted using distance learning methods and techniques	
Prerequisites		knowledge mechanics, strength of materials and mathematics	
Department		Faculty of Mechanical Engineering	
Coordinator		dr inż. Marcin Wikło, prof. URad	
The website of the basic organizational unit		http://wm.uniwersytetradom.pl	
E-mail address, phone number of the coordinator		m.wiklo@urad.edu.pl	

LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	C1 - Master the skills of constructing physical and mathematical models for vibrating objects and their analysis. C2 - Learn about vibration phenomena, determine the parameters of the vibration damper, and calculate eigenvalues and mode shapes. C3 - Master the ability to model mechanical systems using dedicated software.
Curriculum Content:	Content of Lectures Introductory information. Determination of vibrations. Vibrations in nature and technology. Causes of vibrations, their differentiation, damping, and excitation. Impact of vibrations on the human body. The dynamic individuality of the mechanical system. Categorization of vibrations in vibrating systems. Vibrations of linear systems with one degree of freedom. Harmonic movement. Submission of harmonic movements. Replacement systems. Degrees of freedom. Generalized coordinates. Free vibrations (self) without damping. Free vibrations with viscous damping. Critical suppression. Free vibrations suppressed by dry, structural, and mixed friction. Vibration damping. Forced vibrations of a system with one degree of freedom. Forcing with harmonic force, periodic non-harmonic forces, kinematics, and inertia. Resonance chart. Phase-frequency diagram. Vibrations of linear systems with a finite number of degrees of freedom. The Content of Laboratory Exercises Dynamic models of machines and structures. Building physical and mathematical models for vibrating objects with one degree of freedom. Laying down equations of vibrating motion. Application of the d'Alembert principle and Lagrange equations of the second kind for constructing motion equations for models with a finite number of degrees of freedom. Choosing the method for arranging differential equations of motion. Comparison of vibration damping methods. Dynamic isolation effect. Ways of inducing and supporting vibrations. Examples. Calculating natural frequencies and presenting vibrations of systems with 2 or 3 degrees of freedom. Basics of MBD. Utilization of dedicated software to conduct simulations.
Didactic (educational) methods:	Informative lecture and calculation exercises
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 the required learning out comes specified for the course. The average obtained by the students' grades from the exam-lecture and the project-lab exercises

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
	Has basic knowledge in the field of mechanical vibrations of discrete systems and their application in engineering calculations and knows the impact of vibrations on the environment and on the human body	K_WG01, K_WG02, K_WG05, K_WG17	Lecture	Exam	Written exam
	Is able to build differential equations of free and forced vibrations for discrete mechanical models, determine	K_UW02	Lecture	Exam	Written exam, project

	eigenfrequencies and mode shapes, build simple testing set up for vibration presentation and calculate the response to kinematic, inertia and harmonic forces	K_UW08 K_UW09, K_UK18, K_UK18 K_UO19	Exercise	Credit for a grade	
	Is able to use the software to conduct the dynamic simulation mechanical models along with the determination of the time and frequency dependent responses.	K_UW02 K_UW05 K_UU21	Exercise	Credit for a grade	projec
	Is able to cooperate and work in a group and understands the non-technical aspects of the engineer-mechanic activity, including the impact on the environment	K_KK01, K_KO02, K_KO04	Exercise, lecture	Verbal evaluation	Verbal evaluation

Literature and teaching aids
Primary literature: 1. Daniel J. Inman, Engineering vibrations, Pearson International Edition, 2009 2. Singiresu S. Rao, Mechanical Vibrations, Pearson 2004, 2011, 2017 Additional literature: 1. Osiński Z., Teoria drgań, PWN, Warszawa, 1978. 2. Arczewski K., Pietrucha J., Szuster J. T., Drgania układów fizycznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2008. 3. Osiński Z., Tłumienie drgań mechanicznych. PWN, Warszawa, 1979. 4. Parszewski Z., Drgania i dynamika maszyn, WNT, Warszawa, 1982. 5. Den Hartog J. P., Drgania mechaniczne, PWN, Warszawa, 1971. 6. Osiński Z. (red), Zbiór zadań z teorii drgań, PWN, Warszawa, 1989. 7. Kruszewski J., Wittbrodt E., Drgania układów mechanicznych w ujęciu komputerowym, WNT, Warszawa, 1992. 8. Woroszył S., Przykłady i zadania z teorii drgań, PWN, Warszawa, 1979. Study aids: Materials provided during the course

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits		
Attendance, participation	Student workload [h].	
	Student's self-study hours Classes without a teacher (ZBN**)**	Classes
Participation in lectures/classes/lab	X	45 [h]
Preparation for lectures/classes/lab , Preparation for credit / exam	55 [h]	X
Total student workload Preparation for ... credit / exam	77 [h]/ 2.5 ECTS	33 [h]/ 1.4 ECTS
ECTS points per subject	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).