THE DOCTORAL SCHOOL OF IPPT PAN

COURSE OFFERED IN THE DOCTORAL SCHOOL OF IPPT PAN

Name of the course	Polish	**Podstawy teorii drgań układów dyskretnych I ciągłych**				
	English	**Fundamentals of Vibration Theory for Discrete and Continuous Systems**				
Type of the course	**Specialized course**					
Course coordinator	**Prof. Tomasz Szolc, Ph.D., D.Sc., Mech. Eng.**		Course teacher	**Prof. Tomasz Szolc, Ph.D., D.Sc., Mech. Eng.**		
Implementing unit	**ZTI**	Scientific discipline / disciplines	**Mechanical engineering**			
Level of education	**doctoral studies**	Semester	**summer or winter**			
Language of the course	**English or Polish**					
Type of assessment	**examination**	Number of hours in a semester	**30**	ECTS credits	**4**	

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	**2**	**0**	**0**	**0**	**0**
	in a semester	**30**	**0**	**0**	**0**	**0**

1. Prerequisites

Knowledge of mathematics in the field of higher technical studies, including the ability to solve ordinary and selected partial differential equations. Fundamentals of general mechanics, rigid body dynamics and basics of physics in the area of electromagnetism.

2. Course objectives

The aim of the course is to familiarize students with fundamentals of vibration theory for discrete and continuous systems including also wave propagation effects. This lecture is mainly dedicated to mechanical systems and structures, nevertheless, the gained knowledge can be also used for current vibrations in electrical circuits. Moreover, the primary cases of parametric, self-excited, non-linear vibrations, vibrations of rotating systems as well as fundamentals of dynamic diagnostics and vibro-isolation of technical objects will be considered.

3. Course content (separate for each type of classes)

Lecture

Main topics:

1. Fundamentals of mechanical vibration theory.
2. Dynamic analysis of discrete systems.
3. Dynamic analysis of continuous and discrete-continuous (hybrid) systems.
4. Fundamentals of elastic and visco-elastic wave propagation in one - and two-dimensional media.
5. Fundamentals of parametric, self-excited, non-linear vibrations and vibrations of rotating systems.
6. From the continuous system to finite elements.
7. Introduction to dynamic diagnostics and vibro-isolation problems.

Laboratory

- does not apply

4. Learning outcomes			
Number of the learning outcome	Learning outcomes description	Reference to the learning outcomes according to the 8th level of PRK	Learning outcomes verification methods*
Knowledge			
1	The graduate acquires basic knowledge of the theory of vibrations of discrete and continuous systems	P8S_WG	examination
2	The graduate acquires basic knowledge about the types of vibrations and methods of their analysis.	P8S_WG	examination
3	The graduate knows how to transfer the acquired knowledge to the industrial sphere and disseminate the results of his research.	P8S_WK	assessment of activity during classes
Skills			
1	The graduate is able to solve problems of natural vibrations and examine the forced vibrations of discrete and continuous systems as well as analyze the dynamic characteristics of mechanical systems and structures.	P8S_UW	examination
2	The graduate is able to solve the basic equations of motion of natural and forced vibrations of discrete and continuous systems and examine electromechanical analogies.	P8S_UW	examination
3	The graduate is ready to apply the acquired knowledge of the theory of vibrations of discrete and continuous systems in the field of his/her scientific research.	P8S_UW	assessment of activity during classes and examination
4	The graduate is able to transfer the acquired knowledge to the industrial environment and disseminate the results of his research.	P8S_UW	assessment of activity during classes
Social competences			
1	The graduate is ready to think and act in a creative and entrepreneurial way.	P8S_KO	assessment of activity during classes
2	The graduate is ready to critically evaluate the achievements of the represented scientific discipline, including his or her own contribution to the development of this discipline.	P8S_KK	assessment of activity during classes

*Allowed learning outcomes verification methods: exam; oral exam; written test; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria
assessment of activity during classes, results of the examination

6. Literature
Primary references:
[1] **Kaliski S. et. al.**: *Vibration and Waves*, PWN Eds. Warsaw 1966. (*in Polish*)
[2] **Kruszewski J. et. al.**: Finite Element Method for Dynamics of Structures, (team work), Arkady Eds., Warsaw, 1984. (*in Polish*)
Secondary references:
[1] **Dimarogonas A.**: *Vibration for engineers*, Prentice Hall, Upper Saddle River, New Jersey 07458, 1996.
[2] **Den Hartog J. P.**: *Mechanical Vibrations*, Courier Corporation, 1985.

7. PhD student's workload necessary to achieve the learning outcomes**		
No.	Description	Number of hours
1	Hours of scheduled instruction given by the lecturer in the classroom	**30**
2	Hours of consultations with the lecturer, exams, tests, etc.	**15**
3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	**25**
4	Amount of time devoted to the preparation for exams, test, assessments	**35**
	Total number of hours	**105**
	ECTS credits	**4**

** 1 ECTS = 25–30 hours of the PhD students work (2 ECTS ≈ 60 hours; 4 ECTS ≈ 110 hours, etc.)