THE DOCTORAL SCHOOL OF IPPT PAN

COURSE OFFERED IN THE DOCTORAL SCHOOL OF IPPT PAN

Name of the course	Polish	**Wstęp do technik pomiarowych w mechanice konstrukcji**
	English	**Introduction to measurement techniques in structural mechanics**

Type of the course	**Specialized course with laboratory**		
Course coordinator	**Prof. Tomasz Szolc, Ph.D., D.Sc., Mech. Eng.**	Course teacher	**Grzegorz Mikułowski, Ph.D., D.Sc., Mech. Eng.**
Implementing unit	**ZTI**	Scientific discipline / disciplines	**Mechanical engineering**
Level of education	**Doctoral studies**	Semester	**winter**
Language of the course	**English or Polish**		
Type of assessment	**exam**	Number of hours in a semester	**15**
		ECTS credits	**1**

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	**2**			**2**	
	in a semester	**8**			**7**	

1. Prerequisites

Knowledge of mathematics in the field of higher technical studies. Fundamentals of general mechanics, rigid body dynamics, structural mechanics vibration theory.

2. Course objectives

The course is devoted to fundamentals of experimental measuring techniques and data processing in structural mechanics. The course contains two educational blocks: lectures and practice course.

The lectures are dedicated to elementary aspects of measuring issues suitable for structural mechanics testing. The practice course contains conducting experiments using the hydraulic machine for material testing system and experiments by means of the drop-test tower.

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

Lecture

1. Techniques and equipment in experimental structural mechanics.
2. Characterization of transducers utilized in experimental structural mechanics.
3. Fundamentals of digital signal processing.

Laboratory

1. Strain measurements with resistance strain gauges and photogrammetric triangulation methods. Experiments using the hydraulic material testing machine.
2. Data acquisition related to transient mechanical quantities in dynamic test. Experiment using the drop test tower.
3. Experimental modal analysis methods.

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 data processing and analysis techniques dedicated to structural mechanics.	P8S_WG	examination
2	The graduate acquires basic knowledge of the data acquisition techniques in mechanical systems.	P8S_WG	active participation during classes
Skills			
1	The graduate is able to understand data acquisition, data processing and data analysis problems in structural mechanics.	P8S_UW	examination
2	The graduate is ready to apply the acquired knowledge of the data acquisition in the field of his/her scientific research.	P8S_UW	active participation during classes
Social competences			
1	The graduate is ready to critically evaluate the acquired data sets in the represented scientific discipline, including his or her own contribution to the development of this discipline.	P8S_KO	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] A. G. Piersol, T. L. Paez, Harris' shock and vibration handbook, McGraw-Hill, London, 2009
[2] A. Ambardar, Digital signal processing: A modern introduction, Michigan Technological University, 2003
Secondary references:
[1] S. V. Modak, Analytical and Experimental Modal Analysis, CRC Press, 2024

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	**15**
2	Hours of consultations with the lecturer, exams, tests, etc.	**10**

3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	**5**
4	Amount of time devoted to the preparation for exams, test, assessments	**5**
	Total number of hours	**35**
	ECTS credits	**1**

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