COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S2-ME-203**
	part-time programme:	
Course title in Polish	**Mechanika doświadczalna**	
Course title in English	**Experimental Mechanics**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**second-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**all**
Department responsible	**Department of Machine Design and Machining**
Course leader	**dr hab. inż. Jarosław Gałkiewicz, prof. PŚk**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**programme-specific**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester II**
	part-time programme	**Semester II**
Pre-requisites		
Examination required (YES/NO)		**NO**
ECTS value		**2**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**15**		**15**		
	part-time programme					

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	Has in-depth knowledge of the behavior of engineering materials under load and parameters describing this behavior.	MiBM2_W02
	W02	Has in-depth knowledge of advanced material properties used by engineers and how to measure them.	MiBM2_W08
Skills	U01	Is able to acquire knowledge of the properties of materials from literature, databases and other sources and on their basis is able to predict the behavior of the material under load.	MiBM2_U03
	U02	Is able to proficiently operate with data obtained during experiments to determine material constants. Is able to efficiently present the results of their activities.	MiBM2_U05
	U03	Is able to perform complex measurements of material properties using strength machines and their accessories.	MiBM2_U10
Competence	K01	Understands and knows the need to learn new research methods and advanced measuring equipment that improves professional competences.	MiBM2_K01
	K02	Is aware of the impact of engineering activities in the field of determining material constants on non-technical aspects of life and in particular on human safety.	MiBM2_K02

COURSE CONTENT

Mode of instruction	Topics covered
lecture	Material properties important from the strength point of view. Fracture of brittle materials. Stress distribution ahead of the crack tip in a linear-elastic material. Stress intensity factor (SIF) and energy release rate. Fracture criterion. Determination of the critical SIF value. Stress and strain distribution ahead of the crack tip in elastic-plastic materials. J-integral. Fracture criteria for an elastic-plastic material described by the Ramberg-Osgood law. Determination of the critical value of the J-integral. Crack tip opening displacement – Irwin's model and Dugdale's model. Experimental determination of crack tip opening displacement and crack tip opening angle. Dynamic fracture toughness. Fatigue strength of materials. Development of fatigue cracks. Study of the fatigue process.
laboratory	Modern testing machines. Control principles, calibration and organization of measurements. Determination of material properties based on uniaxial tensile test. Determination of fracture toughness of linear-elastic material in plane strain state - K_{IC}. Determination of fracture toughness for elastic-plastic material, critical value of the J-integral - J_{IC}, using standard methods. Measurement of crack tip opening displacement (CTOD), crack opening angle (COA) crack tip opening angle (CTOA) based on ASTM standards. Study of low-cycle fatigue range. Measurement of strain field in notched specimens.

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			

W02			X			
U01					X	
U02					X	
U03					X	
K01						X
K02						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	The pass mark is a minimum of 50% for the final in-class test.
laboratory	non-examination assessment	Submitting and defending class reports with a positive assessment.

OVERALL STUDENT WORKLOAD

ECTS weighting												
No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
		L	C	Lb	P	S	L	C	Lb	P	S	
1.	Scheduled contact hours	**15**		**15**								h
2.	Other contact hours (office hours, examination)	**2**		**2**								h
3.	**Total number of contact hours**	**34**										h
4.	**Number of ECTS credits for contact hours**	**1,4**										ECTS
5.	**Number of independent study hours**	**16**										h
6.	**Number of ECTS credits for independent study hours**	**0,6**										ECTS
7.	**Number of practical hours**	**25**										h
8.	**Number of ECTS credits for practical hours**	**1,0**										ECTS
9.	**Total study time**	**50**										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**2**										ECTS

READING LIST

1. Gałkiewicz J., Lis Z., Molasy R., Neimitz A. Mechanika doświadczalna. Laboratorium. Wyd. PŚk, 1999.
2. Neimitz A.: Mechanika pękania. PWN, 1998.
3. Gołaski L., Elementy doświadczalnej mechaniki pękania, Wyd. Politechniki Świętokrzyskiej, Kielce 1992.
4. ASTM E-399, “Standard Test Method for Plane-Strain Fracture Toughness of Metallic Materials”
5. ASTM E1820-24 Standard Test Method for Measurement of Fracture Toughness.
6. Anderson T. L. Fracture Mechanics. Fundamental and Application, CRC Press, 2011