MODULE DESCRIPTION

Module code	full-time studies:	**Z-ZIP1-E-309**
	part-time studies:	**Z-ZIPN1-E-309**
Module name	**Techniques of laboratory research**	
Module name in Polish	**Techniki badań laboratoryjnych**	
Valid from academic year	**2019/2020**	

MODULE PLACEMENT IN THE SYLLABUS

Field of study	**MANAGEMENT AND PRODUCTION ENGINEERING**
Level of education	**1st degree**
Studies profile	**General**
Form and method of conducting classes	**Full-time and Part-time**
Specialisation	**All**
Unit conducting the module	**Department of Production Engineering**
Module co-ordinator	**Krzysztof Dubaj, MSc**
Approved by:	**Dariusz Bojczuk, PhD, DSc**

MODULE OVERVIEW

Type of subject / group of subjects	**Major**
Module status	**Compulsory**
Language of conducting classes	**English**
Module placement in the syllabus - semester	**Semester III**
Initial requirements	**No requirements**
Examination (YES/NO)	**NO**
Number of ECTS credit points	**2**

Method of conducting classes		**Lecture**	**Classes**	**Laboratory**	**Project**	**Other**
Per semester	full-time studies:			**30**		
	part-time studies:			**18**		

TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	A student knows the statistical methods necessary for the processing and analysis of independently collected measurement data and basic engineering quantities.	ZIP1_W01
	W02	A student has engineering knowledge necessary to use experimental data to calculate basic flow quantities, such as: pressure, flow rate, average fluid velocity, temperature.	ZIP1_W02
	W03	A student knows the physical units of the SI system, with particular emphasis on units related to flows. He knows how to convert them and use their exponential form for the needs of analysis of measurement results.	ZIP1_W02
	W04	A student has knowledge of collecting, verifying and processing engineering measurement data related to fluid flow.	ZIP1_W06
Skills	U01	Has the ability to independently plan and perform measurements of basic physical quantities, including obtaining measurement data using data acquisition stations, as well as interpreting the obtained measurement results and drawing conclusions.	ZIP1_U03
	U02	Has the ability to explore data using appropriate computer programs and analyze this data and present it in a visual form	ZIP1_U04
	U03	Has knowledge of environmental protection and occupational health and safety to the extent necessary to participate in experimental research with the use of mechanical and electrical devices.	ZIP1_U16
Social competences	K01	Understands the need for self-education in solving engineering tasks and improving own professional competences	ZIP1_K01
	K02	Is aware of the importance and impact of the engineering decisions made on the environment.	ZIP1_K02
	K03	Is aware of the impact of his attitude, behavior and commitment on the effect of teamwork in the implementation of a joint project, including an experiment.	ZIP1_K04

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Laboratory	Laboratory research techniques, health and safety rules, principles of hydraulic systems operation. Getting to know the research functions of the reo-flow laboratory with particular emphasis on the measurement of such physical quantities as pressure and intensity of the flowing fluid and temperature. Performing control and measurement tests verifying the computer reading with the use of a signal source and data acquisition station and visualization of the results. Learning the principles of measuring the pressure difference. Calibration of the differential pressure transducer, used in future laboratory activities, using a two-arm liquid manometer. Experimental determination of the linear loss factor in a closed conductor with the use of analog-to-digital converters. Experimental determination of the characteristics of the flow installation and the flow machine. Collection of data needed to determine the system operating point.

	Experimental determination of the local loss coefficient for a selected flow element with the use of analog-to-digital converters. Experimental determination of the linear loss coefficient for two closed pipes of different diameters and made of different materials. Computer processing of measurement data collected during the experiment, in order to: verify the computer reading, calibrate the converter, determine the linear and local loss coefficients and determine the characteristics of the machine and the flow installation.

METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes *(select X)*					
	Oral exam	**Written exam**	**Test**	**Project**	**Statement**	**Other**
W01					X	
W02			X		X	
W03			X		X	
W04			X			
U01					X	
U02					X	
U03						X
K01						X
K02						X
K03						X

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Laboratory	Credit with grade	Passing all reports and obtaining at least 50% of points from all tests.

STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
1.	Participation in the activities	Lc	C	Lb	P	O	Lc	C	Lb	P	O	h
				30					18			
2.	Other (consultation, exam)			2					2			h
3.	**Number of hours of a student's assisted work**	**32**					**20**					h
4.	**Number of ECTS credit points which are allocated for assisted work**	**1,3**					**0,8**					ECTS
5.	**Number of hours of a student's unassisted work**	**18**					**30**					h
6.	**Number of ECTS credit points which a student receives for unassisted work**	**0,7**					**1,2**					ECTS
7.	**Work input connected with practical classes**	**50**					**50**					h
8.	**Number of ECTS credit points which a student receives for practical classes**	**2,0**					**2,0**					ECTS
9.	**Total number of hours of a student's work**	**50**					**50**					h
10.	**Punkty ECTS za moduł** *1 ECTS=25 hours*	**2**										ECTS

LITERATURE

1. Anderson D., Tannehill J., Pletcher R. (2020), *Computational Fluid Mechanics and Heat Transfer*, CRC Press.
2. Janna W. (2020), *Introduction to Fluid Mechanics*, Sixth Edition, CRC Press.
3. Montgomery D. (2009), *Engineering Statistics*, Student Study Edition 4th Edition, Wiley.