

MODULE DESCRIPTION

Module code	Z-ZIP-0101
Module name	Metrologia
Module name in English	Metrology
Valid from academic year	2016/2017

A. MODULE PLACEMENT IN THE SYLLABUS

Field of study	Management and Production Engineering
Level of education	1st degree <i>(1st degree / 2nd degree)</i>
Studies profile	General <i>(general / practical)</i>
Form and method of conducting classes	Full-time <i>(full-time / part-time)</i>
Specialisation	All
Unit conducting the module	The Department of Manufacturing Engineering and Metrology
Module co-ordinator	Prof. Stanisław Adamczak, PhD hab., Eng.
Approved by:	

B. MODULE OVERVIEW

Type of subject/group of subjects	Major <i>(basic / major / specialist subject / conjoint / other HES)</i>
Module status	Compulsory <i>(compulsory / non-compulsory)</i>
Language of conducting classes	English
Module placement in the syllabus - semester	4th semester
Subject realisation in the academic year	Summer semester <i>(winter / summer)</i>
Initial requirements	No requirements <i>(module codes / module names)</i>
Examination	No <i>(yes / no)</i>
Number of ECTS credit points	4

Method of conducting classes	Lecture	Classes	Laboratory	Project	Other
Per semester	20	10	15		

C. TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Module target	The aim of the module is to acquire knowledge as regards the methods and tools applied in length and angle measurements. Other aims comprise the following: applying basic measurement techniques concerning quality control individually; individual planning of the range and methodology of research and measurements as well as preparing reports concerning an analysis of measurement uncertainty using the methods of mathematical statistics.
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Effect symbol	Teaching results	Teaching methods (l/c/lab/p/other)	Reference to subject effects	Reference to effects of a field of study
W_01	A student has knowledge as regards the principles of planning length and angle measurements as well as preparing reports using the methods of mathematical statistics.	l/c/lab	K_W01	TIA_W01 TIA_W07
W_02	A student has knowledge as regards the principles of making length and angle measurements in quality control using basic measurement tools as well as modern measuring equipment.	l/c/lab	K_W08	TIA_W04
W_03	A student has knowledge as regards the methods and techniques used in quality assurance of products and manufacturing processes.	l/c/lab	K_W09	T1A_W04
U_01	A student is able to make basic measurements of geometric values connected with the manufacturing process.	c/lab	K_U09	TA1_U08
K_01	A student understands the necessity of continuous improvement of his/her knowledge as regards measurement techniques.	l/c/lab	K_K01	T1A_K01
K_02	A student is aware of the responsibility for his/her own work and is able to co-operate with the research team.	c/lab	K_K04	T1A_K03 T1A_K04

Teaching contents:

1. Teaching contents as regards lectures

Lecture number	Teaching contents	Reference to teaching results for a module
1	The essence of metrology, division, significance in different branches of science and technology; basic notions and definitions.	W_03
2	Quantity: the division of quantity, quantity systems, units of measurement, and the systems of units of measurement.	W_01 W_03
3	Tolerances and fits. The principles of calculating fit indicators as well as designing basic-shaft and basic-hole fits.	W_01 W_03
4	Measurement methods, measurement errors, definitions, division, general methods of calculating, and the selected issues of probability calculus.	W_01 W_02
5	The selected issues of mathematical statistics having their application in metrology.	W_01 W_02
6	The methods of calculating incidental errors in direct and indirect measurements; the methods of determining and eliminating systematic errors.	W_01 W_03
7	The examples concerning analyses and syntheses of incidental and systematic errors.	W_01 W_03
8	Measurement equipment: division, structure, components, metrological and utility properties.	W_02 W_03
9	Length and angle metrology: the dimensions and their division, universal and	W_02

	special measurement tools. Device computerisation.	W_03
10	A summary. Obtaining a credit for the lectures.	W_01 W_02 W_03

2. Teaching contents as regards classes

Class number	Teaching contents	Reference to teaching results for a module
1	Basic principles concerning calculating tolerances and fits.	W_01 W_02 W_03
2	Probability calculus: distribution parameters – calculating and interpretations.	W_01 W_03
3	Error calculus; incidental errors in direct measurements.	W_01 W_03
4	Error calculus; incidental errors in indirect measurements.	W_01 W_03
5	A summary. Obtaining a credit for the classes.	W_01 W_02 W_03

3. Teaching contents as regards laboratory classes

Laboratory class number	Teaching contents	Reference to teaching results for a module
1	Introduction. Discussing the principles of conducting classes and OHS requirements.	K_02
2	The structure, components, and the rules of work of measuring devices.	W_02 W_03 K_01 K_02
3	Analysing incidental errors in direct measurements.	W_01 W_02 W_03 U_01 K_01 K_02
4	Analysing incidental errors in indirect measurements.	W_01 W_02 W_03 U_01 K_01 K_02
5	Determining an accuracy class of measuring devices.	W_02 W_03 U_01 K_01 K_02
6	Comparative tests of metrological properties concerning measuring devices.	W_01 W_02 W_03 U_01 K_01 K_02
7	Acoustic tests applied in machine construction.	W_02 W_03 U_01 K_01

		K_02
8	Obtaining a credit for the classes.	W_02 W_03 U_01

4. The characteristics of project assignments

The methods of assessing teaching results

Effect symbol	Methods of assessing teaching results <i>(assessment method, including skills – reference to a particular project, laboratory assignments, etc.)</i>
W_01	Lectures: a written test in the form of simple questions. Classes: a test checking calculation skills: measurement uncertainty in direct and indirect measurements and the parameters of probability distribution. Laboratory classes: quality assessment concerning preparing reports on the conducted research.
W_02	Lectures: a written test in the form of simple questions. Laboratory classes: an initial test assessing preparation for the classes; constant supervision and correction of measurement methods.
W_03	Lectures: a written test in the form of simple questions.
U_01	Laboratory classes: checking the ability of conducting measurements during the classes through initiative assessment.
K_01	Comments during the lectures and a discussion during the classes.
K_02	A constant supervision and remarks concerning the allocation of tasks in a team while conducting measurements during laboratory classes.

D. STUDENT'S INPUT

ECTS credit points		
	Type of student's activity	Student's workload
1	Participation in lectures	20
2	Participation in classes	10
3	Participation in laboratories	15
4	Participation in tutorials (2-3 times per semester)	5
5	Participation in project classes	
6	Project tutorials	
7	Participation in an examination	
8		
9	Number of hours requiring a lecturer's assistance	50 <i>(sum)</i>
10	Number of ECTS credit points which are allocated for assisted work <i>(1 ECTS point=25-30 hours)</i>	2
11	Unassisted study of lecture subjects	15
12	Unassisted preparation for classes	10
13	Unassisted preparation for tests	10
14	Unassisted preparation for laboratories	15
15	Preparing reports	
15	Preparing for a final laboratory test	
17	Preparing a project or documentation	
18	Preparing for an examination	
19		
20	Number of hours of a student's unassisted work	50 <i>(sum)</i>
21	Number of ECTS credit points which a student receives for unassisted work <i>(1 ECTS point=25-30 hours)</i>	2
22	Total number of hours of a student's work	100
23	ECTS points per module <i>1 ECTS point=25-30 hours</i>	4
24	Work input connected with practical classes <i>Total number of hours connected with practical classes</i>	50
25	Number of ECTS credit points which a student receives for practical classes <i>(1 ECTS point=25-30 hours)</i>	2

E. LITERATURE

Literature list	<ol style="list-style-type: none"> 1. Jakubiec W., Malinowski J., <i>Metrologia wielkości geometrycznych</i>, WNT Warszawa 2007, wydanie V. 2. Adamczak S. Makiela W., <i>Metrologia w budowie maszyn. Zadania z rozwiązaniami</i>, WNT, Warszawa 2007, wydanie II zmienione. 3. Adamczak S. Makiela W., <i>Podstawy metrologii i inżynierii jakości dla mechaników. Ćwiczenia praktyczne</i>, WNT, Warszawa 2010, wydanie I. 4. Adamczak S., <i>Pomiary geometryczne powierzchni. Zarysy kształtu, falistość i chropowatość</i>, WNT, Warszawa 2008. 5. Adamczak S., Sender E., <i>Ćwiczenia laboratoryjne z podstaw metrologii</i>, WPS, wyd. III, Kielce 1996. 6. Humienny Z. i inni, <i>Specyfikacje geometrii wyrobów (GPS)</i>, WNT, Warszawa
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	<p>2004.</p> <p>7. <i>Mała encyklopedia metrologii</i>, WNT, Warszawa 1989.</p> <p>8. <i>Poradnik metrologa warsztatowego</i>, WNT, Warszawa 1972.</p> <p>9. Arendarski J., <i>Niepewność pomiarów</i>, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2003.</p> <p>10. Białas S., <i>Metrologia techniczna z podstawami tolerowania wielkości geometrycznych dla mechaników</i>, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1997.</p>
Module website	