COURSE DESCRIPTION CARD – SPECIMEN

<table>
<tr><td colspan="10">Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6"></td><td colspan="2">Degree level and programme type</td><td>Bachelor's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6"></td><td colspan="2">Study profile</td><td></td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Metrology and measuring systems</td><td colspan="2">Course code</td><td>IS-FME-00166S</td></tr>
<tr><td colspan="2">Course type</td><td></td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td colspan="2">Semester</td><td>summer</td></tr>
<tr><td>30</td><td>15</td><td>15</td><td></td><td></td><td></td><td></td><td colspan="2">No. of ECTS credits</td><td>5</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Mathematics II</td></tr>
<tr><td>Course objectives</td><td colspan="9">To provide the students with the knowledge of: basic vocabulary used in metrology measurement methods, measurement inaccuracies and methods of processing the results of measurements. Student will: obtain the understanding the problems associated with statistic method in random errors, develop the skills to present the final result, has knowledge of the analysis and processing of measurement signals, construction and operation of measuring converters, structure and organization of measurement systems (SP), coordinate measuring technology, be able to evaluate tolerance, limits of tolerance and design the fits, perform measurements of mechanical parts dimensions using universal metrology instruments as well as perform accuracy control by selecting adequate measurement technique with regard to geometry of the measured item and dimensional tolerance.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: Methods of measurement. Foundations of systematic errors and of the theory of random errors. Statistic methods in metrology. The system of limits and fits. Classification and analysis of measurement signals. The structure and organization of measurement systems. Coordinate measuring technique. Classes: Design of fits. Statistic evaluation of random errors and confidence intervals for a population of measurements. Calculation of sample systematic errors. Tolerances analysis. Laboratory classes: Measurements of mechanical parts dimensions using universal metrology instruments. Measurements of: arches, screw threads, sprockets, angles of cones and chokes and assessment of surface roughness.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Regular lectures: blackboard lectures with presentations and worked examples, discussions
Regular classes: blackboard classes, work in groups, discussion, homework assignments,
Laboratory classes: work in groups, problem solving
Self- study: under supervision: tutorial sessions with worked examples, discussion, problem solving, homework assignments.</td></tr>
<tr><td>Assessment method</td><td colspan="9">Lecture - written exam; classes – written exam; laboratory classes - written test and written reports from measurements</td></tr>
<tr><td>Symbol of learning</td><td colspan="8">Learning outcomes</td><td>Reference to the learning</td></tr>
</table>

outcome		outcomes for the field of study
LO1	Student is able to list, classify and describe measurement methods and errors of measurement	M1_W15
LO2	Student performs basic calculations of limiting errors and uncertainty, the tolerances and fits, analysis and synthesis of dimensional chain	M1_W15, M1_U12, M1_W09, M1_U14, M1_U15
LO3	Students describes the principle of coordinate metrology	M1_W15, M1_U11
LO4	Students is able to classifies and analyzes the measurement signals	MK1_W04
LO5	Students is able to explains the rules of the organization measurement systems, to lists and describes the selected elements of measurement systems	M1_W15, M1_W19
LO6	Student performs measurements of mechanical parts dimensions using universal metrology instruments and is able to interpret obtained findings	M1_U11, M1_U12, M1_K04

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	written exam	L
LO2	written exam	L, C, LC
LO3	written exam	L
LO4	written exam	L
LO5	written exam	L
LO6	written test, written report from measurements	LC

Student workload (in hours)		No. of hours
Calculation	lecture attendance	30
	participation in classes, laboratory classes, etc.	30
	preparation for classes, laboratory classes, projects, seminars, etc.	25
	working on projects, reports, etc.	20
	participation in student-teacher sessions related to the classes/seminar/project	15
	implementation of project tasks	10
	TOTAL:	**130**

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	75	**3**
Student workload – practical activities	55	**2**

Basic references	**1.** *Metrology and measurement*, Anand K. Bewoor, Vinay A. Kulkarni, Tata McGraw-Hill Education, New Delhi 2009, **2.***The metrology handbook, second edition*, Jay L. Bucher, PhD editor, ASQ, Milwaukee, Wisconsin 2012 **3.** *Coordinate Metrology*, Jerzy A. Sładek, Springer-Verlag Berlin Heidelberg, 2016, **4.** *Coordinate Measuring Machines and Systems*, John A. Bosch, New York 1995, **5.** *Advances in coordinate metrology*, Jerzy Sładek and Władysław Jakubiec. Bielsko-Biała : Wydaw. Akademii Techniczno-Humanistycznej, 2010.
Supplementary references	**1.** *Practical engineering metrology* / Sharp K.W.B., London : Pitman Paperbacks, 1970, **2.** *Engineering Metrology and Measurements*, Raghavendra, N.V.; Krishnamurthy, L., Oxford University Press, 2013

Organisational unit conducting the course	Dept. of Materials and Production Engineering	**Date of issuing the programme**
Author of the programme	Grzegorz Rogowski, PhD, Eng.	**28.03.2021**

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar