COURSE GUIDE

Subject name	**Fundamentals of metrology**
Course of study	**Quality and Production Management**
The form of study	**Full-time**
Level of qualification	**First**
Year	**I**
Semester	**II**
The implementing entity	**Department of Information Management Systems**
The person responsible for preparing	**dr inż. Artur Wrzalik**
Profile	**General academic**
ECTS points	**2**

TYPE OF TEACHING – NUMBER OF HOURS PER SEMESTER

LECTURE	CLASS	LABORATORY	PROJECT	SEMINAR
15		**15**	**-**	**-**

COURSE AIMS

C1. Presentation and discussion of basic issues of metrology.
C2. To familiarize students with the rules of using measuring apparatus.
C3. Communicate knowledge about estimating methods and measuring uncertainty.

ENTRY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows basic maths problems.
2. Student knows the basic issues of electrical engineering.
3. Student can build simple electrical systems.
4. Student can operate electrical equipment.
5. Student knows the rules for safe use of electrical equipment.

LEARNING OUTCOMES

EU1. Student can explain basic metrology issues..
EU2. Student can identify the basic types of measuring instruments and present their principles of operation.
EU3. Student can use the measuring apparatus.
EU4. Student can determine the measurement errors.

COURSE CONTENT

Type of teaching – Lecture	**Number of hours**
W1,W2. Metrology - subject and task, basic concepts.	2
W3. Measurement as a source of information.	1
W4. Size, measurement, pattern, measuring instrument.	1
W5. Measurement methods.	1
W6. International System of Units.	1
W7,W8. Measurement errors and their classification.	2
W9,W10. Measurement of geometrical quantities.	2
W11. Measurement of mass, temperature and pressure.	1
W12,W13,W14. Methods and techniques for measuring electrical quantities.	3
W15. Legal metrology.	1
Type of teaching - LABORATORY	**Number of hours**
L1,L2. Introductory terms - laboratory rules of metrology, principles of laboratory exercises.	2
L3,L4. Measurement of direct and indirect current.	2

L5,L6. Analogue ammeter accuracy test.	2
L7,L8. Measurement of direct and indirect voltage.	2
L9,L10. Measurement of basic geometrical quantities.	2
L11,L12. Measurement of the mass.	2
L13,L14. Measurement of resistance using the technical and comparative method.	2
L15. Knowledge check.	1

TEACHING TOOLS

1. Handbooks and scripts.
2. Audio-visual equipment.
3. Instructions for exercises.
4. Measuring instruments and other equipment provided by the Laboratory of Metrology.

WAYS OF ASSESSMENT (F – FORMATIVE, P – SUMMATIVE)

F1. Level of preparation for laboratory exercises.
F2. Commitment during laboratory exercises.
P1. Correct execution of laboratory exercises.
P2. Reports from laboratory exercises.

STUDENT WORKLOAD

Form of activity		**Average number of hours for realization of the activity**		
		[h]	ECTS	ECTS
Contact hours with the teacher	Lecture	15	0.6	0.6
Contact hours with the teacher	Laboratory	15	0.6	0.8
Preparing to classes		5	0.2	
Preparing reports		10	0.4	0.4
Consultation		5	0.2	0.2
TOTAL NUMBER OF HOURS / ECTS CREDITS FOR THE COURSE		**50**	**2**	

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

Basic resources

1. Raghavendra N.V., Krishnamurthy L. Engineering Metrology and Measurements. Oxford University Press, Oxford 2013.
2. Dotson C. Fundamentals of Dimensional Metrology. Cengage Learning, Inc., Boston 2015.
3. Jain R.K. Engineering Metrology. Khanna Publishers. Delhi 2009.

Supplementary resources

1. Bucher J.L. The Metrology Handbook. ASQ Quality Press, Milwauke 2012.
2. Gupta S.V. Mass Metrology. Springer-Verlag, Berlin 2012.
3. Beewor A.K., Kulkarni V.A. Metrology & Measurement. Tata McGraw-Hill Education Private Limited, New Dehli 2009.

TEACHERS (NAME, SURNAME, E-MAIL ADDRESS)

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MATRIX OF LEARNING OUTCOMES REALISATION

Learning outcome	**Reference of given outcome to outcomes defined for whole program (PRK)**	**Course aims**	**Course content**	**Teaching tools**	**Ways of assessment**
EU1	K_W01, K_W07, K_W09, K_U01, K_U02, K_U11	C1	W1,-W4, W6, W15, L1, L2	1, 2	F1
EU2	K_W01, K_W05, K_W09, K_U02,	C1, C2	W4, W5, L5,	1, 2, 4	F1

	K_U04, K_U05, K_U08, K_U09, K_U11		L6		
EU3	K_W05, K_W07, K_W08, K_W09, K_U01, K_U02, K_U04, K_U07, K_U08, K_U09, K_U10, K_U11	C2, C3	W7-W14, L3, L4, L7-L14	1, 3, 4	F2, P1, P2
EU4	K_W07, K_W08, K_W09, K_U01, K_U02, K_U04, K_U07, K_U08, K_U09, K_U10, K_U11	C2, C3	W7-W14, L3L14	1, 3, 4	P1, P2

FORM OF ASSESSMENT - DETAILS

	grade 2	**grade 3**	**grade 4**	**grade 5**
EU1	Student cannot explain any of basic principles of metrology.	Student can explain some issues carried out during lectures and laboratories.	Student can explain most of the issues carried out during lectures and laboratories.	Student can explain all of the issues carried out during lectures and laboratories.
EU2	Student cannot identify basic types of measuring instruments and present the principles of their operation.	Student can identify some types of measuring instruments discussed during classes and present the principles of their operation.	Student can identify most types of measuring instruments discussed during classes and present the principles of their operation.	Student can identify all types of measuring instruments discussed during classes and present the principles of their operation.
EU3	Student cannot use measuring equiupment while carrying out measurements in the laboratory.	Student can correctly use a limited number of measuring equipment.	Student can correctly use most of the measuiring equipment.	Student can correctly use all of the measuiring equipment in the laboratory.
EU4	Student cannot determinate measurement errors.	Student can determinate measurement errors with significant problems.	Student can determinate most of measurement errors while carrying out measurements.	Student can correctly determine all measurement errors while carrying out measurements.

ADDITIONAL USEFUL INFORMATION ABOUT THE COURSE

1. Information where presentation of classes, instruction, subjects of seminars can be found, etc. - presented to students during first classes, if required by the formula classes are sent electronically to the e-mail addresses of individual dean groups.
2. Information about the place of classes - Information can be found on the website of the Faculty of Management.
3. Information about the timing of classes (day of the week / time) - Information can be found on the website of the Faculty of Management.
4. Information about the consultation (time + place) - Information can be found on the website of the Faculty of Management.