MODULE SPECIFICATION

Module code	
Module title in Polish	**Geodezja 4 (z ćwiczeniami terenowymi)**
Module title in English	**Surveying 4 (including practice in the field)**
Module running from the academic year	**2016/2017**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Surveying and Cartography**
Level of qualification	**first cycle** (first cycle, second cycle)
Programme type	**academic** (academic/practical)
Mode of study	**full-time** (full-time/part-time)
Specialism	**all**
Organisational unit responsible for module delivery	**The Department of Geotechnical Engineering. Geomatics and Waste Management**
Module co-ordinator	**Krzysztof Pietruszka, PhD, Eng.**
Approved by:	**Ryszard Florek-Paszkowski, PhD, Eng.**

B. MODULE OVERVIEW

Module type	**core module** (core/programme-specific/elective HES*)
Module status	**compulsory module** (compulsory/optional)
Language of module delivery	**English**
Semester in the programme of study in which the module is taught	**semester 4**
Semester in the academic year in which the module is taught	**summer semester** (winter semester/summer semester)
Pre-requisites	**None** (module code/module title, where appropriate)
Examination required	**Yes** (Yes/No)
ECTS credits	**5**

* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per	15		30		30

semester					

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C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to prepare students (both theoretically and practically) for future professional work as regards surveyors' activity in surveying enterprises.

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student knows the applied spatial mapping systems, reference systems, cartographical references and appropriate coordinate systems. A student has basic knowledge as regards the applied cartographical projections.	l/l	GiK_W01 GiK_W04 GiK_W10	T1A_W01 T1A_W03
W_02	A student knows basic measurement methods, techniques and tools applied while solving engineering tasks as regards surveying and cartography in spatial reference systems.	l/l	GiK_W27 GiK_W10	T1A_W07 T1A_W03
W_03	A student knows surveying instruments as well as the principles of controlling and rectifying them (together with utilising them in terms of making spatial observations in reference systems).	l/l	GiK_W01 GiK_W12	T1A_W01 T1A_W03
U_01	A student can utilise information as regards surveying and cartography; a student can also correctly apply it in surveying works. Furthermore, a student is familiar with the methods of searching information included in other bibliographic and Internet sources; finally, a student can assess this information in terms of its relevance.	l	GiK_U01	T1A_U01,
U_02	A student can consciously utilise computer software in execution on the basis of measurement results.	l	GiK_U02	T1A_U01
U_03	A student can prepare surveying technical documentation; furthermore, a student prepare an engineering project on surveying.	l	GiK_U07, GiK_U24	T1A_U03, T1A_U16
U_04	A student can make calculations in spatial systems together with a detailed analysis concerning measurement accuracy of measurement and calculations.	l	GiK_U10	T1A_U07
U_05	A student can take surveying measurements as regards determining spatial coordinates.	l	GiK_U14	T1A_U08
U_06	A student can check the correctness of operation as regards measurement instruments and check their rectification.	l	GiK_U30	T1A_U03, T1A_U06
K_01	A student is aware of the responsibility for the realisation of teamwork as regards measurement and surveying calculations.	l	GiK_K06	T1A_K03
K_02	A student can co-operate and work in a team as regards common realisation of surveying tasks.	l	GiK_K07, GiK_K09, GiK_K10	T1A_K03 T1A_K06
K_03	A student has competences as regards the organisation of terrain works.	l	GiK_K11	T1A_K03

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code

1	The measurements of vertical angles. Theoretical conditions of constructing angle measuring equipment in terms of measuring vertical angles. Controlling devices prior to measurement. Trigonometric levelling. Accuracy analysis as regards trigonometric levelling.	W_02 W_03
2	Spatial measurements. Determining the height of the accessible point. Measuring the height of the inaccessible point. Measuring the length of a vertical accessible section. Determining the height of rotation axis concerning tacheometer telescope.	W_02
3	Spatial indent. Accuracy analysis as regards determining spatial coordinates in the spatial indent technology. Calculating height difference in the spatial indent technology. Calculating height difference considering refraction and Earth curvature. Calculating height difference on the basis of the zenith angle and length calculated from coordinates. The method of determining the coefficient of refraction.	W_02
4	The systematicity of vertical control according to G-2. Two-function control. Trigonometric series (measurement principles). The adjustment of the levelling net. Weights in the series of trigonometric levelling. Calculating the height of points in the series of trigonometric levelling. The contents of measurement documentation of trigonometric levelling.	W_01 W_02
5	Tacheometry as a land survey and height measurement with the polar method. Technological development of classical tacheometry from an optical tacheometer to electronic tacheometer. Modern equipment for tacheometer measurement. GPS-RTK tacheometer and receivers. The methods of conducting the measurement and registering the results of a tacheometric measurement. Point encryption.	W_03
6	The principle of measuring land relief. The interpolation of contours and determining the error of contour height with the method of a control profile. Modular networks. Utilising free stands. Levelling a tacheometric control and calculating spot height coordinates.	W_02
7 – 8	Topographic maps prepared in Poland in the post-war period. Reference systems. The types of mapping, reference levels and the dimensions of a reference ellipsoid. WDG-84 ellipsoid. International Map of the World (systems of map sheets at a scale of 1:10000). The systems of map sheets in the systems. The contents of topographic maps. The application of topographic maps as regards the works of surveying controls.	W_01

2. Topics to be covered in the laboratory classes

No.	Topics	Module outcome code
1 – 2	Measurements at eccentric stands and their reductions. Measuring the transfer of coordinates of an inaccessible point. Checking instruments prior to measurement.	U_01 U_05 U_06 K_01
3	Determining the height of an accessible point.	U-05 K_02
4 – 5	Measuring the length of a vertical accessible section. Measuring the height of an inaccessible point.	U_01 U_05 K_02
6 – 7	Spatial indent (the measurement and accuracy analysis).	U_02 U_05 K_02
8	Calculating height difference taking refraction and Earth curvature into consideration. Calculating horizontal length taking refraction and Earth curvature into consideration. The methods of determining the coefficient of refraction.	U_01 U_03 U_05 K_02
9 – 10	Measuring a trigonometric series. The adjustment of the levelling net with one nodal point. Weights in trigonometric levelling. Calculating the height of points in the series of trigonometric levelling. The contents of a sketch of a trigonometric net.	U_02 U_03 U_05 K_02
11 – 12	Electronic tacheometry. Tacheometry as a land survey and height measurement with the polar	U_01

	method. Modern equipment for tacheometric measurement. The methods of conducting measurements and registering the results of tacheometric measurement. The encryption of points.	U_05 K_02 K_03
13	The principle of measuring land relief and preparing tacheometric measurements. Measuring a fragment terrain in order to prepare land survey and height map.	U_05 K_02 K_03
14 - 15	Levelling a tacheometric control and calculating the coordinates of height points. Preparing a map at a scale of 1:1000 with the use of available programs.	U_02 U_03 U_04 K_02 K_03

3. Topics to be covered in the field work classes

No.	Topics	Module outcome code
1	**Electronic tacheometry** 1. Searching the existing horizontal and vertical control on the basis of topographic descriptions 2. Establishing a measurement control on an area of ca. 20 hectares. 3. Land survey and height measurement on the indicated terrain. 4. Height reference of a measurement control with the geometrical or trigonometric levelling. 5. Detailed levelling of the measurement control with the use of the available programs. 6. A discussion and analysing the measurement and preparing levelling results and accuracy analysis. 7. Preparing a land survey and height map at a scale of 1:1000. 8. The measurement and preparation of a terrain control profile. Calculating the error of contour height. 9. Controlling the land survey and height map in a terrain and a discussion on the quality of preparing it.	W_02 W_03 U_01 U_02 U_03 U_04 U_05 U_06 K_01 K_02 K_03
2	**The assumptions of a third-class detailed control** 1. Preparing project assumptions of the third-class detailed control 2. Reconnaissance. Searching reference points. Designing new control points. Preparing topographic descriptions. 3. Making a technical network description. 4. The measurement of side length angles as well as height differences in the network. 5. Comparing the angles (directions), length values as well as trigonometric levelling results with the use of the spreadsheet. 6. Detailed levelling of a situational and height control. Discussing levelling results.	W_02 W_03 U_01 U_02 U_03 U_04 U_05 U_06 K_01 K_02 K_03

Assessment methods

Module outcome code	**Assessment methods** *(Method of assessment; for module skills – reference to specific project, laboratory and similar tasks)*
W_01 W_02 W_03	An oral or written examination

U_01 U_02 U_03 U_04 U_05 U_06	Assessing a student's involvement during laboratory classes
K_01 K_02 K_03	Assessing a student's involvement during teamwork

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**15**
2	Contact hours: participation in classes	**30**
3	Contact hours: participation in laboratories	**30**
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**3**
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	**2**
8		
9	**Number of contact hours**	**80** *(sum)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**3.2**
11	Private study hours: background reading for lectures	**10**
12	Private study hours: preparation for classes	**10**
13	Private study hours: preparation for tests	
14	Private study hours: preparation for laboratories	**10**
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	**5**
17	Private study hours: preparation of a project/a design specification	
18	Private study hours: preparation for an examination	**10**
19		
20	**Number of private study hours**	**45** *(sum)*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**1.8**
22	**Total study time**	**125**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**5**
24	**Number of practice-based hours** *Total practice-based hours*	**80**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**3.2**

E. READING LIST

References	1. Grafarend E .: 3D Linear Similarity Coordinate Transformation between a Global Geodetic System and a Local Geodetic System without Local Ellipsoidal Heights, Geodetic Theory Today. International Association of Geodesy Symposia. Third Hotine-Marussi Symposium on Mathematical Geodesy L'Aquila, Italy, May 30–June 3, 1994 2. Krakiwsky E.J. , Thomson D.B.: Geodetic Position Computations, Department of Geodesy and Geomatics Engineering University of New Brunswick , 1974-February 3. Yetkin, M. :Optimal Design of Deformation Monitoring Networks Using the Global Optimization Methods, The1st International Workshop on the Quality of Geodetic Observation and Monitoring Systems , Proceedings of the 2011 FIG International Workshop, Munich, Germany April , 2011.

Module website	Introduction to Surveying , https://www.pstu.ac.bd/uploads/resources/L-021.pdf Introduction to Adjustment Calculus http://www2.unb.ca/gge/Pubs/LN35.pdf