

# KLAIPĖDA STATE UNIVERSITY OF APPLIED SCIENCES

## Faculty of Technologies

**STUDY PROGRAMME:** GEODESY  
**NAME OF THE SUBJECT:** BASICS OF GEODESY  
**CODE OF THE SUBJECT:** TF-G-2-017

Group of the subject*	Type of the subject**	Form of studies	Structure***				Total number of hours	Number of credits
			T	P	C	I		
SF	P	Full-time studies (FT)	34	55	6	65	160	6
		Part-time studies (PT)	10	24	61	65		

\*Group of the subject: GS – general study subjects; SF – subjects of the study field.

\*\*Type of the subject: C – compulsory subject; A – optional subject (alternative), FE – freely elective subject.

\*\*\*Structure: T – theory; P – seminars, workshops, laboratory works; C – consultations; I – individual work.

### Annotation

The subject provides theoretical knowledge about the selection of geodetic measuring instruments, ways and methods of measurement, as well as their application for compaction works of geodetic base. It will form practical skills by designing and creating horizontal plans and longitudinal and transversal profiles, as well as by performing assessment of precision of measurement results. Technical regulations of geodesy and cartography will also be analysed and applied.

### The connection of results of the study programme with results of the study subject and study methods, as well as evaluation methods of the learning achievements

Results of the study programme	Results of the study subject	Study methods	Evaluation methods of the learning achievements
A2. A student will demonstrate knowledge and understanding about the measuring, design and construction methods and ways, technical measures used to take such actions, as well as their management methods and principles of quality assurance	A2.1. A student will understand and use methods to measure lines and angles, ways to display situation, use schemes of theodolite traverses, as well as understand meanings of forward and back grid angle and geodetic task.	Demonstration of theoretical material, explanation, individual practical and independent works and study of the educational material in “Moodle” virtual learning environment.	A test and provision of practical and individual work results.
B1. A student is able to apply the acquired knowledge to implement the latest technologies and to solve the tasks, related to geodesy, cartography and cadastre and register of real estate, as well as territorial planning; a student is also able to select measurement methods to obtain the necessary data	B1.1. A student will be able to select and apply methods to measure lines and angles, scales and ways to display situation in order to conclude a horizontal plan by applying “GIS” technologies.	A lecture, Demonstration of theoretical material, explanation, practical work, individual work, study of the educational material in “Moodle” virtual learning environment, and project work.	Verbal questions, provision of practical and individual work results.
B2. A student uses methods of mathematical-statistical processing of measurement data, measurement reliability and determination of indeterminacy by collecting, structuring and analysis information	B2.1. A student will understand the construction of measuring instruments, use checking and adjusting methodology, apply methods and ways to identify non-conformity of areas, theodolite and levelling	Demonstration of theoretical material, explanation, instruction and technical work, work in the groups, study of the educational material in “Moodle”	Verbal interview, provision of the report prepared by a group and provision of practical and individual work results.

obtained during measurements.	traverses, as well as measuring coupling system.	virtual learning environment.	
D1. A student is able to use modern measurement devices, organise and analyse measurement results optimally, as well as applies methods of administration, formation and assessment of real estate, which comply with standards and regulations of Lithuania and the European Union	D1.1. A student will be able to perform function analysis of devices (drones, 3D scanners and GPNS receivers), organise measurements and process measurement results in mathematical ways and by applying "GIS" technologies.	A lecture, demonstration, explanation, instruction and technical work, check conversation, work in the groups and study of the educational material in "Moodle" virtual learning environment.	Verbal interview and provision of the report prepared by a group.
C1. A student applies measurement information for engineering research and to solve other applicable tasks, to design various types of maps, measurement databases of information systems, and to apply legislation in the professional activities.	C1.1. A student will be able to design and create a plan of situational contours of the location by applying "GIS" technologies, to perform compartment surveys with the latest geodetic devices (drones, 3D scanners and GPNS receivers) according to technical regulations of geodesy and cartography.	A lecture, Demonstration of theoretical material, explanation, analysis of legislation, graphic works and their documentation, as well as study of the educational material in "Moodle" virtual learning environment.	Provision of practical and individual work results and defence of graphic works.
D2. A student has the skills that are necessary for the performance of practical research, planning of experiments, design and performance, starting with formulation of a problem, selection of research equipment and ending with assessment of results and qualification; a student is also able to select proper ways and methodology, as well as to perform reliable measurements	D2.1. A student will be able to analyse and select measuring instruments for compaction works of geodetic base and to associate measurements with the geodetic network. D2.2. A student will be able to assess the measurement accuracy of lines and angles: to calculate relative error of a line and to perform measurement control of angles.	Demonstration of theoretical material, explanation, conversational check, solving of geodetic tasks and study of the educational material in "Moodle" virtual learning environment.	Verbal questions and provision of practical and individual work results.

### Contents and scope of the subject

Topic name and content description	Number of the contact hours, FT form			Number of the contact hours, PT form			I	Total number of hours
	T	P	C	T	P	C		
<b>1. General knowledge about geodesy.</b> Classification of geodesy, relations with other sciences and historical features. Shape and size of the Earth. Coordinate systems. Altitude systems. Measurement units. Types of geodetic works and plans. Maps, plans and profile. Conventional signs. Scales. An individual work.	4	-	1	2	-	3	4	9
<b>2. Measurement and orientation of lines.</b> Marking of lines and points. Comparison of plastic tape measure and self-retracting metal tape measure. Measurement of lines by using plastic tape measure and self-retracting metal tape measure. Corrections of lengths of the measured line. Measurement accuracy of lines. Horizontal projection of the inclined line. Meridian lines. Convergence angle. Bearings and a link	8	10	1	2	4	13	8	27

<p>between them. A practical work No 1. Creation of scales and drawing. Objectives: to draw various linear scales and to apply them in practice; to understand a significance of the scale in the measurement plane; to create linear scales according to the given principle of creation; to draw scales in lines, which correspond to the graphic accuracy of a scale; to identify the accuracy of the scales and to calculate lengths of the lines by using such scales. An individual work.</p> <p>Objective: to learn calculating horizontal projections of the inclined lines.</p> <p>A practical work No 2. Relationship between azimuths and bearings. Objectives: to understand the meaning of azimuth and bearing; to recalculate (convert) azimuths to bearings and vice versa.</p> <p>An individual work No 2. Forward and back azimuths and bearings.</p> <p>Objective: to understand the meanings of forward and back azimuths and bearings; to recalculate (convert) forward azimuths and bearings to back azimuths and bearings and vice versa.</p>								
<b>A test.</b>	2			2			2	4
<p><b>3. Theodolite, its check, study, adjustment and measurement with it.</b> The principle for measurement of angles. Theodolite.</p> <p>Types of theodolites. Preparation of theodolite for measurement works. Measurement of angles by theodolite. Measurement of distances by filar range-finder of theodolite. Practical work No 3. Construction of theodolites and measurement by them.</p> <p>Objectives: to acknowledge with construction of theodolite; to prepare theodolite for work; to learn how to read the limb of theodolite, to measure horizontal and vertical angles by using method of sections and to measure distance by using filar range-finder of theodolite. An individual work No 3. Study of theodolite.</p> <p>Objective: to study whether theodolite meets certain optical and geometric conditions.</p> <p>An individual work No 4. Check and adjustment of optical theodolites.</p> <p>Objective: to analyse check of the primary conditions and adjustment of theodolite, and to prepare conclusions.</p> <p>Preparation of a practical work.</p>	4	10	1	-	6	9	6	21
<p><b>4. Creation of a horizontal plan.</b> To link theodolite traverse with geodetic base. Non-conformity. Measurement of angles of theodolite traverse. Measurement of lines of theodolite traverse. Calculation of theodolite traverses. Creation of situational plan of location. Methods used to display situation of the location. Analytical calculation of areas by using coordinates. Practical work No 4. Creation of a horizontal plan. Objective: to calculate coordinates of the closed and extended traverse points and to draw a horizontal plan according to photo sketches of a situation and indications of conventional signs. Tasks: To calculate non-conformity of inner angles of the closed and extended traverses and to arrange them; to calculate grid angles of sides of the closed and extended traverses; to calculate increase of coordinates, their non-conformities and to arrange them; to calculate non-conformities of perimeter of the closed and extended traverses and a relative measurement error of its sides; to compare a relative error with permissible error; to calculate</p>	8	18	1	2	8	17	14	41

<p>coordinates of tops of the closes and extended traverses; to calculate the size of a page and to draw a network of coordinates; to lay the closed and extended traverses by using coordinates; to display situation and to format a plan.</p> <p>An individual work No 5. Back geodetic task.</p> <p>Objective: to solve back geodetic task and to understand the significance of its application.</p> <p>Practical work No 5. Calculation of area by using coordinates. Objective: to calculate area of a polygon by using analytical method of area calculation.</p> <p>An individual work. Preparation of a practical work.</p>								
<p><b>5. Levelling instruments, their types, check and adjustment.</b></p> <p>Types of levelling instruments. Construction of levelling instruments and their preparation for use. Check and adjustment of levelling instruments. Practical work No 6. Construction of levelling instruments and measurement by them.</p> <p>Objective: to acknowledge with the construction of technical levelling instruments and to know how to perform measurements by using them; to prepare a levelling instrument for measurement; to know how to measure with them by using various methods. Tasks: to acknowledge with construction of technical levelling instruments and measuring instruments; to learn how to read the readings in the measuring rod of the levelling instrument and how to draw a drawing of the reading; to perform technical levelling and to find the difference of altitudes between the levelling points.</p> <p>An individual work No 6. Check and adjustment of levelling instruments.</p> <p>Objective: to analyse check and adjustment of geometric conditions of the levelling instrument and to prepare conclusions.</p>	-	6	1	-	1	6	10	17
<p><b>6. Levelling of axis and drawing of profiles.</b></p> <p>Levelling methods. Referencing to the benchmark</p> <p>Non-conformities. Picketage of a route. Levelling of a route. Calculation of altitudes of route points. Creation of longitudinal and transverse profiles of a route.</p> <p>Practical work No 7. Creation of longitudinal and transverse profiles of a route by applying "GIS" technologies.</p> <p>Objective: to design longitudinal and transverse profiles of a route in a methodological manner; to identify and calculate primary design elements of a route. Tasks: to calculate the differences of altitudes between the connection points and to perform control; to calculate non-conformities with differences of heights of the extended traverse, to check the permissibility, to calculate corrections and to arrange them; to calculate altitudes of connection and intermediate points; to calculate the primary elements of a curve; to draw a longitudinal profile and a design line, to calculate altitudes of a design line, work heights; to identify position of zero points and altitudes of points, as well as to create a transverse profile by applying "GIS" technologies.</p> <p>An individual work.</p>	8	11	1	2	5	13	11	31
<b>Preparation for the examination.</b>	-	-	-	-	-	-	10	10
<b>Total number of hours:</b>	34	55	6	10	24	61	65	160

#### Assessment system of results of the subject studies

Result number of the study subject	Assessment criteria of results of the study subject
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A2.1.	Understanding and use of methods for measuring lines and angles, ways to display situation, use of the schemes of theodolite traverses, understanding of the meanings of forward and back grid angle and geodetic task.
B1.1.	Selection of methods for measuring lines and angles, application of methods to display scales and situation in order to create photo of a situation.
B2.1.	Performance of functional analysis of devices, reading in the measuring rods, measuring organisation and processing of measuring results by using mathematical ways.
C1.1.	Understanding of construction of measuring instruments, the use of check and adjustment methodology, application of methods and ways identifying non-conformity of areas, theodolite and levelling traverses, as well as application of measuring coupling system.
C2.1.	Design and creation of a plan of situational contours of the location, performance of compartment surveys in accordance with regulations of geodesy and cartography.
C3.1.	Analysis and selection of measuring instruments for compaction works of geodetic base, association of measurements with geodetic network.
C3.2.	Assessment of measurement accuracy of lines and angles.

#### Procedure of evaluation

A ten-point criterial grading scale and system of cumulated grading are applied.

$$IKV = \sum_{i=1}^n X_i \times k_i$$

n – number of interim assessments (5),

X<sub>i</sub> – evaluations for interim assessments and examination,

k<sub>i</sub> – weighted coefficients of interim assessments and examination.

Examination can be taken by students, whose average of interim evaluations is at least 5 points.

#### Recommended literature and other information sources

Primary literature and information sources			
No	Literature and information sources	Number of copies	
		At the library of the Faculty of Technologies	At other libraries of Klaipeda State University of Applied Sciences
1	Braziulienė G. (2010). <i>Geodezijos pagrindai</i> . UAB Vitae Litera, Kaunas.	80	-
2	Braziulienė G. (2010). <i>Geodezijos pagrindų praktiniai ir savarankiški darbai</i> . KU, Klaipėda.	38	-
3	Ghilani Ch. D., Wolf P. R. (2012). <i>Elementary surveying: an introduction to geomatics</i> . Westford United States of America.		
4	Kriaučiūnaitė – Neklejonovienė V., Sližienė G., Živatkauskas A., Venskus S., Sližys J., Stravinskienė V. (2008). <i>Geodezija</i> . Vaistų žinios, Vilnius.	20	-
5	Ruzgienė B., Aleknienė E. (2004). <i>Elementary surveying</i> . Technika, Vilnius.		
6	Zakarauskas V. (2013). <i>Geodezijos pagrindai</i> . Kaunas.	E-book	-

Additional literature and information sources	
No	Literature and information sources
1	Tamutis Z., Tulevičius V., Žalnierukas A. (1992). <i>Geodezija</i> . 1d. Mokslas, Vilnius.
2	Tamutis Z., Kazakevičius S., Petroškevičius P., Žalnierukas A. (1996). <i>Geodezija</i> . 2d. Mokslas, Vilnius.
3	Variakojis P. (1984). <i>Geodezija</i> . Mokslas, Vilnius.
4	Ghilani Ch. D., Wolf P. R. (2012). <i>Elementary surveying: an introduction to geomatics</i> . Westford United States of America.
5	Kennedy M. (2009). <i>Introducing Geographic information systems with ArcGIS: a workbook approach to learning GIS</i> . Hoboken (N.J.): John Wiley & Sons.

6	Longley, Paul A. (2006). <i>Geographical information systems and science</i> . Chichester: John Wiley & Sons, Ltd.
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**Description of the subject was prepared by:**

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Lecturer  
(Position)

\_\_\_\_\_  
(Signature)

Gražina Braziulienė  
(Academic degree, name and surname)

\_\_\_\_\_  
Lecturer  
(Position)

\_\_\_\_\_  
(Signature)

Dainora Jankauskienė  
(Academic degree, name and surname)