KLAIPEDA STATE UNIVERSITY OF APPLIED SCIENCES

Faculty of Technologies

STUDY PROGRAMME: **GEODESY**
STUDY SUBJECT: **PHOTOGRAMMETRY**
SUBJECT CODE: **TF-G-2-028**

Subject group*	Subject type**	Form of studies	Structure***				Hours, total	Credits
			T	P	K	S		
SK	P	Full-time (NL)	24	38	4	39	105	4
		Part-time (I)	10	26	30	39		

*Subject group: BS—general study subjects; SK—subjects of the study field.
**Subject type: P—compulsory subject; A—optional subject (alternative), LP—elective.
***Structure T—theory; P—seminars, placements, laboratory works; K—consulting; S—self-studying.

Annotation

The study subject analyses photogrammetric mapping technologies and their application for drawing up topographic to obtain cadastral data and spatial geoinformation from photographic images. The tasks being solved are related to air photo geometry, coordinate system transformation, aerotriangulation. Practical skills for photo orientation processes and stereoscopic measurements are developed. Technical tools for aerial photography are analysed and peculiarities of interpretation of photographic images are examined. Theoretical and practical knowledge is provided to enable acquisition of aerial mapping products and development of orthophotographic maps by applying digital photogrammetry methods.

Links between the learning outcomes of the programme and the outcomes of the study subject as well as the study methods and the student performance assessment methods

Learning outcomes of the programme	Learning outcomes of the study subject	Study methods	Student performance assessment methods
A2. Demonstrates knowledge and understanding of measurement, design, construction methods and techniques, as well as technical tools used for these actions, their management methods and quality assurance principles.	A2.1. The student will know the main principles for the application of photogrammetric measurements to the development of topographic maps.	Theoretical materials are studied in lectures. Practical application of the teaching materials demonstrated via computer tools	Intermediate questionnaires of the theoretical part. Tests.
B2. Demonstrates knowledge and understanding of measuring instruments, traceability system, metrology basics, methods of mathematical statistical processing of measurement data, methods of determining measurement reliability and uncertainty, and is able to accumulate, systematise and analyse information obtained from measurements.	B2.1. The student will be aware of air photo processing methods, devices and software. B2.2. The student will understand photogrammetric measurement procedures and the importance of applying calculation results. B2.3. The student will understand photogrammetric data for mapping and will be able to evaluate the results of interpreting photographic images.	Individual practical and independent work. Task solving by using computer systems. Studying of teaching materials in a virtual learning environment.	Presentation of individual practical and independent works performed by using computer systems. Verbal analysis of the results.
D1. Able to use modern measuring instruments and to optimally organise	D1.1. The student will be able to apply photogrammetric	Assimilation of theoretical materials.	Quality assessment of practical and

and perform measurements, process and analyse measurement results, apply real estate administration, formation and assessment methods in compliance with Lithuanian and EU standards and regulations.	methods for processing photographic images, interpreting physical and cartographic environment.	Analysis of practical and independent work results/cases. Studying of teaching materials in a virtual learning environment.	independent works. Oral defence of the work report.
D2. Has practical skills of planning, designing and carrying out research and experiments, from the formulation of the problem, the selection of research equipment to the evaluation and qualification of the outcomes and findings; is able to choose the right methods and techniques and perform reliable measurements.	D2.1. The student will be able to design an air photo, a photogrammetric support network and to competently perform photogrammetric measurement procedures.	Photogrammetric work drafts. Discussions, debates in lectures.	Presentation of the prepared project and verification chat.
D3. Able to use information technology, basic software, apply and use numerical computer methods for solving specific engineering problems, use computers for obtaining and processing problem-solving data, process management, automated design, computer graphics.	D3.1. The student will be able to choose the photogrammetric measurement method and software for obtaining the necessary data from photographs and to use the regulatory documents.	Independent study of theoretical material. Search for additional information in virtual cyber-space.	Written examination includes theoretical questions and problem tasks.
E1. Able to communicate with colleagues, executives and clients in a correct and logical written and oral manner in Lithuanian and at least one foreign language, using modern information and communication technologies, and to work in a multidisciplinary group/team.	E1.1. The student will be able to apply information gained from literature sources in Lithuanian and foreign language (English, Russian, etc.) to improve knowledge in the field of photogrammetric mapping.	Studying of literature sources.	Oral presentation or a poster announcement of a self-produced report.

Subject content and scope

Topic name and content description	**Number of contact hours**						**S**	**Hours, total**
	full-time			**part-time**				
	T	**P**	**K**	**T**	**P**	**K**		
1. Definition of photogrammetry science. Results of photogrammetric measurements. Types of photos. Fields of application of photogrammetry science, its branches, link with GIS, overview of its development.	2	-	-	1	-	1	2	4
Independent work No. 1. Description of maps drawn up by a photogrammetric method.								
2. Design of air photos. Air photo design technology and design parameters. Air photo coordination: contours, photogrammetric points, photogrammetric aerotriangulation.	2	-	-	1	-	1	3	5
Independent work No. 2. Determining the parameters of air photo design and the accuracy of air photos.								
3. Photogrammetric requirements for aerial photography from an unmanned aerial vehicle (*UAV*). Description of a *UAV* system. Photogrammetric support network. Conditions and design parameters for the aerial photography process: flight altitude, ground sample distance (GSD), photo overlap. Aerial mapping products and accuracy.	2	6	1	1	4	4	-	9
Practical work No. 1. Drawing up of an air photo draft by applying *UAV–Fotogrametrija* technology. Design calculations, support network design,								

accuracy requirements.								
4. Technical shooting equipment. Aerial photography uses flying vehicles, such as aircraft, unmanned aerial vehicles (*UAV*). Aerial cameras. Types of digital aerial cameras. Cameras for shooting ground objects. Key characteristics of digital cameras.	4	-	-	1	-	3	-	4
5. Geometric features of air photos. Geometric elements of air photos. Scale variety in photographs. Inner and outer orientation parameters of air photos. Development of a spatial image.	2	-	-	1	-	1	2	4
Independent work No. 3. Description and graphic representation of geometric elements of air photos.								
6. Interpretation of photographic images. Technology, tools and features for the interpretation of air photos and space photos.	2	4	-	1	2	3	5	11
Practical work No. 2. Interpretation of a photographic image. Space image content analysis and object classification. Presentation of interpretation results in symbols by using GIS measures.								
Independent work No. 4. Visual on-site interpretation and processing of interpretation results.								
7. Digital photogrammetry. Definition and features of digital images. Geometric and radiometric resolution of photographs. Physical principles for obtaining photographic images. Colour distribution in photographic images.	2	4	-	1	3	2	-	6
Practical work No. 3. Solving of digital photogrammetry tasks. Description of digital image properties and coordinate system. Evaluation of the accuracy of results of image matching and photogrammetric measurements.								
Processing of practical and independent works, preparation for defence and actual defence.	-	2	-	-	1	1	6	8
8. Digital photogrammetric mapping. Technological processes and products. Digital photogrammetric systems. Orientation of photographic images. Definition of the model. Stereoscopic measurements. Surface modelling methods. Matching of photographic images. Generation of orthophotographic maps.	4	14	1	1	8	10	-	19
Practical work No. 4. Generation of an orthophotographic map. Orientation of air photographs, development of a surface/terrain model and generation of an orthophotographic photo. Software system *DDPS*.								
Practical work No. 5. Generation of a spatial model and digital photogrammetric mapping. Photogrammetric mapping of air photos, generation of a 3D model. Stereoscopic mapping of terrain objects. Software system *LISA*: *LISA FOTO* and GIS module *LISA BASIC.*								
9. **Technology and products for processing photographic images obtained by using a *UAV* system**. Description of the software system (*Pix4D*). Preparation of photogrammetric data. Initial processing of photographic images. Quality analysis. Generating a point cloud and grid. Generation of a DSM and orthophotographic image.	2	6	1	1	6	2	-	9
Practical work No. 6. Processing of photographic images obtained by using *UAV- Fotogrametrija* technology. Surface modelling and generation of orthophotographic photo mosaic. Software system *PIX4Dmapper*:								
10. Overview of photogrammetric-GIS technology. Land surface laser scanning (*LIDAR*). Ground laser systems. Mobile photogrammetric mapping. Remote sensing methods.	2	-	-	1	-	1	-	2
Drawing up of a report on practical and independent works, preparation for defence and actual defence.	-	2	-	-	2	-	6	8
Preparation for examination	-	-	1	-	-	1	15	16
Total number of hours	**24**	**38**	**4**	**10**	**26**	**30**	**39**	**105**

Evaluation system for subject learning outcomes

Study subject learning outcomes No.	Subject learning outcome evaluation criteria
A2.1.	Assimilation of the key principles of creating topographic maps of photogrammetric measurements.
B2.1.	Formulation of the quality of the interpretations of photographic images and formulation of conclusions.
C1.1. C1.2. C1.3.	Understanding and application of phases of photographic image processing. Understanding the importance of the application of the results of photogrammetric measurements and calculations. Understanding the data needed to compile maps in a photogrammetric way.
C3.1.	The ability to perform design tasks to obtain photogrammetric data.
C4.1.	Problem solving and argumentation by choosing the method of photogrammetric measurements and the software system.
D1.1.	Self-studying of photogrammetric cartography literature.

Assessment procedure

A ten-point criterion scale and a cumulative individual assessment system are applied.

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

n—number of intermediate assignments (assessment of 1 test, assessment of 2 independent works, assessment of 5 practical works—60%).

Xi—assessment of intermediate assignments and the examination (assessment of a test—20 %, assessment of independent works—20%, assessment of practical works—60%).

ki—weighted coefficients of intermediate assignments and the examination (all intermediate works are assessed on a ten-point criterion scale from 5 to 10 points; the weighted coefficient of all intermediate assignments is 1).

Examinations can be sat by students with an average intermediate assignment score of at least 5.

Recommended literature and other sources of information

Key literature and sources of information			
No.	**Literature and sources of information**	**Number of copies**	
		At the library of the Faculty of Technologies	**At other libraries of the University**
1.	Gudritienė D., Darbutas A. *Fotogrametrija.* Metodiniai patarimai. Lithuanian University of Agriculture. Faculty of Water and Land Management. Land Management Department. Kaunas: Ardiva. 2008.	10	-
2.	Jankauskienė E., Umbrasienė D., Urbanavičienė I. *Fotogrametrija.* Mokymo(si) priemonė. Publishing Centre of Kaunas University of Applied Sciences. 2008.	21	1
3.	Linder W. *Digital photogrammetry: a practical course with CD-ROM*. Berlin: Springer. 2006.	2	-
4.	Ruzgienė B. *Skaitmeninė fotogrametrija: ortofotografinės nuotraukos sudarymas.* Metodikos nurodymai. Klaipėda University Press. 2011.	94	-
5.	Ruzgienė B. *Fotogrametrija.* Vadovėlis. Vilnius Technological University publishing house Technika. 2008.	6	-

Additional literature and sources of information

No.	Literature and sources of information
1.	Braziulienė G. *Geodezijos pagrindų praktiniai ir savarankiški darbai*. Klaipėda University Press. 2010.
2.	Daniulis J. *Aerofotometodai. Aerofotonuotraukų dešifravimas*. Vilnius: Enciklopedija. 1998.
3.	Vainauskas V. *Fotogrametrija*. Vilnius: Mokslas. 1977.

Subject description drawn up by:

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(*position*)	*(signature)*	*(degree, name, surname)*