KLAIPEDA STATE UNIVERSITY OF APPLIED SCIENCES

Faculty of Technologies

STUDY PROGRAMME: **GEODESY**
STUDY SUBJECT: **REMOTE SENSING TECHNOLOGIES**

Subject group*	Subject type**	Form of studies	Structure***				Hours, total	Credits
			T	P	K	S		
SK	P	Full-time (NL)	38	87	9	106	240	9
		Part-time (I)	14	40	80	106		

*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 subject analyses remote sensing (primary data collection method), provides knowledge about the collection of spatial data, chemical, physical and biological properties of objects in a remote manner, by using the latest technologies, directly, avoiding physical contact. Processing, transformation, interpretation and analysis of obtained images to provide meaningful information about the objects and phenomena depicted. The subject examines the physical grounds for remote sensing of the Earth surface, artificial Earth satellites used for remote sensing and their digital data, the application of space images to identify and classify objects on the Earth's surface. The link between remote sensing and geographic information systems is analysed.

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 skills relating to measurement, design, construction methods and techniques, as well as technical tools used for these actions, their management methods and quality assurance principles.	A.2.1. The student will be able to assess the impact of natural conditions on the selection of telemetry methods and to analyse the technical tools used in telemetry methods.	Lecture, demonstration of theoretical material, explanation, independent work, studying of teaching materials in Moodle virtual learning environment.	Oral questions, submission of results of individual works.
A3. Demonstrates knowledge and skills relating to traditional and innovative measurement engineering technologies and their applications, significant in the field of technology science research, design and development, and also has a holistic approach to making engineering decisions, coordinating costs, benefits, safety, quality, reliability and environmental impact, applying the principles of sustainable development.	A.3.1. The student will be able to distinguish installation technologies and types of remote sensors and their operation in different spectral fields.	Lecture, demonstration of theoretical material, explanation, independent work, studying of teaching materials in Moodle virtual learning environment.	Oral questions, submission of results of individual works.
B1 Able to apply the acquired knowledge to master new technologies and to solve geodetic, mapping and spatial information	B.1.1. The student will be able to choose the appropriate method for remote sensing to solve geodetic, mapping or spatial planning tasks and use	Laying out and demonstration of theoretical material, practical group tasks, acquisition of software	Presentation and defence of practical work Written survey

infrastructure, spatial planning tasks; able to choose measurement methods for obtaining the necessary data.	it to obtain suitable images and 3D models.	skills, analysis of scientific and methodical material.	
B2. Uses 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.	B.2.1 The student will be able to select the right software for obtaining the necessary images and 3D models, and prepare, improve, transform and interpret them.	Laying out and demonstration of theoretical material, practical individual tasks, acquisition of software skills.	Presentation of practical work and oral questioning
C1. Applies measurement information for engineering research and solving other applied engineering tasks, designing various engineering maps and IS measurement databases, and applying legal acts in professional activities.	C.1.1. In accordance with the applicable legislation, the student will be able to draw up an appropriate digital map and 3D model.	Lecture, demonstration of theoretical material, explanation, independent work, studying of teaching materials in Moodle virtual learning environment.	Presentation of practical and independent work
D1. Able to use modern measuring instruments and to optimally organise 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.	D.1.1 The student will be able to obtain data and images using various remote sensing methods (LIDAR, Aerophotography, DTM, DEM, DSM) and analyse them with the use of computer programs. D.1.2. The student will be able to analyse the concepts of spatial, spectral and time resolution and to prepare, improve and process the obtained image data by applying appropriate transformation.	Laying out and demonstration of theoretical material, individual and group tasks, strengthening of software skills, analysis of scientific and methodical material.	Presentation and defence of practical work
D3. Able to use 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.	D.3.1 The student, by using the data obtained from remote sensing systems, will be able to apply specific computer programs for creating digital maps and 3D models.	Laying out and demonstration of theoretical material, individual tasks, strengthening of software skills.	Oral questions, submission of results of individual works.

Subject content and scope

Topic name and content description	**Number of contact hours, full-time**			**Number of contact hours, part-time**			**S**	**Hours, total**
	T	**P**	**K**	**T**	**P**	**K**		
1. Basics of remote sensing. The concept, process, essence and meaning of remote sensing.	2	-	-	1	1	-	2	4
2. Data of remote sensing. Practical work No. 1 Remote sensing data.	2	4	-	-	1	5	2	8

Aim: to analyse the history of remote sensing, the data and the forms and methods of their collection.								
3. Telemetry methods. Practical work No. 2 Telemetry methods. Aim: to evaluate the impact of natural conditions on the selection of telemetry methods. To analyse the technical tools used in telemetry methods.	2	8	-	1	4	5	4	14
4. Test (topics 1, 2 and 3). Aim: to prepare for the test.	-	-	1	-	-	1	6	7
5. Remote sensing systems. Practical work No. 3. Remote sensing systems. Aim: to analyse the variety and the use of software systems for processing digital photographic images	4	8	-	1	4	7	6	18
6. Remote sensors. Passive and active sensors. Practical work No. 4. Passive and active sensors. Aim: to analyse installation technologies and types of remote sensors and their operation in different spectral fields.	4	10	-	1	4	9	6	20
Preparation for examination (3rd semester).	-	-	2	-	-	2	7	9
Number of hours in the autumn semester	**14**	**30**	**3**	**4**	**14**	**29**	**33**	**80**
9. Analysis of remote sensing images. Air photos. KD practical task No.1 Air photos. Aim: to study the reliability of terrain elevation data obtained by various methods (of air photography) and to compare them with each other.	4	6	-	1	2	7	8	18
10. Analysis of remote sensing images. LIDAR KD practical task No. 2 LIDAR Aim: to study the reliability of terrain elevation data obtained by various methods (LIDAR) and to compare them with each other.	4	6	-	1	2	7	8	18
11. Analysis of remote sensing images. DTM, DEM and DSM models. KD practical task No. 3 DTM, DEM and DSM models. Aim: to study the reliability of terrain elevation data obtained by various methods (DTM, DEM, DSM) and to compare them with each other.	4	6	-	2	2	6	12	22
12. Processing functions of remote sensing image analysis systems. KD practical task No. 4 12. Analysis of remote sensing images. Aim: to analyse the concepts of spatial, spectral and time resolution and to prepare, improve and process the obtained image data by applying appropriate transformation.	2	8	-	1	4	5	8	18
13. Preparation of remote sensing images. KD practical task No. 5 Preparation of remote sensing images Aim: To correct radiometric and geometric data distortions common for the sensor and the platform with the help of processing operations.	2	9	-	1	6	4	8	19
14. Test (topics 9, 10, 11, 12 and 13). Aim: to prepare for the test.	-	-	2	-	-	2	-	2
15. Improvement and transformation of remote sensing images. KD practical task No. 6 Improvement and transformation of remote sensing images Aim: To improve the images obtained and to facilitate their interpretation by use of computer programs; perform image transformations by various filtration methods.	2	8	-	1	4	5	9	19
16. Interpretation of remote sensing images KD practical task No. 7 Interpretation of remote sensing images Aim: To interpret the obtained images by all features of visual image interpretation, including tone, size, shape, texture, structure,	2	8	-	1	4	5	8	18

shadow, location and relationship.								
17. Use of remote sensing images KD practical task No. 8 Use of remote sensing images Aim: to analyse the possibilities for the use of remote sensing images.	4	6	-	2	2	6	12	22
Preparation and defence of the coursework report (4th semester).	-	-	2	-	-	2	-	2
Preparation for examination (4th semester).	-	-	2	-	-	2	-	2
Number of hours in the spring semester	**24**	**57**	**6**	**10**	**26**	**51**	**73**	**160**
Total number of hours	**38**	**87**	**9**	**14**	**40**	**80**	**106**	**240**

Evaluation system for subject learning outcomes

Subject learning outcome No.	Subject learning outcome evaluation criteria
A.2.1.	Understanding of the impact of natural conditions on the selection of telemetry methods and the use of technical telemetry tools.
A.3.1.	Recognition of installation technologies and types of sensors used in remote sensing and their operation in different spectral fields.
B.1.1.	Selection of the appropriate remote sensing method for solving geodetic, mapping or spatial planning tasks and creation of appropriate images and 3D models.
B.2.1.	Selection of the appropriate software for obtaining the necessary images and 3D models and preparation, improvement, transformation and interpretation of the obtained images.
C.1.1.	Assimilation of legislation governing geodetic and mapping activities and its application for the development of an appropriate digital map and 3D model.
D.1.1.	Analysis of data obtained by various remote sensing methods (LIDAR, Air photos, DTM, DEM, DSM) with the use of specialised computer programs.
D.1.2.	Understanding of the concepts of spatial, spectral and time resolution and preparation, improvement and processing of obtained images by applying appropriate transformations
D.3.1.	Using specific computer programs to create digital maps and 3D models.

Assessment procedure

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

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

n—number of intermediate assignments (assessment of 2 tests, assessment of 3 independent works, assessment of 4 practical works).

X_i—assessment of intermediate assignments and the examination (assessment of tests—30%, assessment of independent work—10%, assessment of practical works—60%),

k_i—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.	Keranen K., Kolvoord R. (2016). *Making spatial decisions using GIS and Lidar : a workbook* . Redlands: Esri press academic	1	-
2.	Mozgeris G., Dumbrauskas A., Jonikavičius D. (2015). *Geografinių informacinių sistemų pagrindai : studijų knyga*. Akademija, Kaunas District : Publishing Centre of the Aleksandras Stulginskis University	5	-
3.	Ruzgienė B. (2011). *Skaitmeninė fotogrametrija: ortofotografinės nuotraukos sudarymas : metodikos nurodymai.* Klaipėda: Klaipėda University Press	98	-
4.	Viliuvienė R., Sikorskytė A., Mineikytė A. (2008). *Geografinės informacinės sistemos : mokymo(si) priemonė.* Kaunas: Publishing	19	-

	Centre of Kaunas University of Applied Sciences		
5.	Qihao Weng (2010). *Remote sensing and GIS integration : theories, methods, and applications*..New York (N.Y.) : McGraw Hill	3	-

Additional literature and sources of information	
No.	**Literature and sources of information**
1.	Kumetaitienė A., Stanionis A. (2010). *Skaitmeninių žemėlapių sudarymas ir duomenų apdorojimas: mokomoji knyga*. Vilnius: Technika.
2.	Tomlin D. (2013). *GIS and cartographic modeling* C.. Redlands, [Calif.]: Esri Press.
3.	Gudritienė D., Darbutas A. (2008). *Aerofotografija ir jos taikymo sritys : mokomoji knyga*. Kaunas : Ardiva
4.	Ruzgienė B. (2008). *Fotogrametrija: vadovėlis*. Vilnius: Technika

Subject description drawn up by:

Lecturer		Indrius Kuklys
(*position*)	*(signature)*	*(degree, name, surname)*
Lecturer		Lina Kuklienė
(*position*)	*(signature)*	*(degree, name, surname)*