

COURSE SYLLABUS

Remote Sensing of MSW objects

**Recommended by the Didactic Council for the Education Field for the specialization:
05.04.06 "Ecology and nature management"**

**The course instruction is implemented within the professional education programme of
higher education:**

«Integrated Solid Waste Management» (Network program with L.N. Gumilyov Eurasian National
University)

1. COURSE GOAL(s)

The course is designed to help students the in-depth study of the method of remote sensing of the Earth and the features of its application for solving the problems of integrated management of production and consumption waste.

• 2. REQUIREMENTS FOR COURSE OUTCOMES

The course implementation is aimed at the development of the following competences:

GC-7.1; GC -7.2; GC -7.3; GPC-3.1; GPC -3.2; GPC -3.3; GPC -3.4; GPC -3.5; GPC -5.1; GPC -5.2; GPC -5.3; PC-5.1; PC-5.2; PC-5.3

Competence code	Competence descriptor	Competence formation indicators (within this course)
GC-7	Able to use basic knowledge in the field of information culture	GC-7.1 Able to use basic knowledge in the field of information culture
		GC-7.2 Formulates a real data processing problem in terms of a real problem
		GC-7.3 Knows the principles and techniques of modern corporate information culture and the basics of the digital economy
GPC-3	Able to apply environmental research methods to solve research and applied problems of professional activity	GPC-3.1 Knows how to identify and has the skills to solve problems, tasks of scientific research in the field of urban geography, environmental problems of cities
		GPC -3.2 Owns modern methods for assessing geoecological information to solve theoretical and practical problems of nature management
		GPC -3.3 Possesses the skills of predicting meteorotropic reactions, assessing the climatic potential of regions, assessing the objectivity of climate change scenarios
GPC -5	Able to solve the problems of professional activity in the field of ecology, nature management and nature protection using information and communication, including geoinformation technologies	GPC -5.1 Knows the theoretical, methodological and practical foundations for the use of information technology in environmental expertise
		GPC -5.2 Owns modern methods for assessing environmental information to solve theoretical and practical problems of environmental safety expertise of nature management
		GPC -5.3 Knows how to choose and apply an algorithm for solving environmental problems and implements algorithms using software
PC-5	the ability to develop standard environmental measures and assess the impact of planned structures or other forms of economic activity on the environment	PC-5.1 Able to assess the impact on the environment of the designed enterprise and facilities, predict and evaluate the negative consequences
		PC-5.2 Able to develop standard environmental measures
		PC-5.3 Possesses the skills of environmental design and preparation of special documentation at the pre-project stage of the project life cycle

As a result of course studying, the student must:

Know:

- theoretical foundations of remote sensing;
- mechanisms and principles of the RSE images obtaining
- basic techniques for photointerpretation the remote sensing images;
- basic techniques of geoinformatics;

Be able to:

- use the methods of aero and space images photointerpretation to solve practical problems in the management of production and consumption waste;
- use the GIS software to solve practical tasks;
- use spectral indices to solve practical tasks
- use spatial analysis of territory to solve practical tasks;

Own :

- skills in working with design and engineering documentation;
- skills of working with normative - legal documentation.

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

Discipline *Remote Sensing of MSW objects* refers to the **Electives** (block 1 of the curriculum).

Within the higher education programme students also master other disciplines (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course.

Table 3.1

The list of the higher education programme components that contribute to the achievement of the expected learning outcomes

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
GC-7	Able to use basic knowledge in the field of information culture	IT in ecology and natural resources management	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
GPC-3	Able to apply environmental research methods to solve research and applied problems of professional activity	-	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
GPC -5	Able to solve the problems of professional activity in the field of ecology, nature management and nature protection using information and communication, including geoinformation technologies	Landscape and geochemical aspects of waste impact	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma

PC-5	the ability to develop standard environmental measures and assess the impact of planned structures or other forms of economic activity on the environment	-	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
-------------	---	---	---

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the discipline is **3** credit units.

Table 4.1. Types of academic activities during the period of the HE program(me) mastering

Types of academic activities	Total hours	Semester(s)			
		1	2	3	4
<i>Contact academic hours</i>					
Lectures	17	17			
Lab works					
Seminars (workshops/tutorials)	17	17			
<i>Self-study</i>	47	53			
<i>Evaluation and assessment (exam; pass/fail grading)</i>	27	33			
The total course workload	hours	108	108		
	credits	3	3		

5. COURSE CONTENT

Table 5.1. Course Modules and Contents

Title of Course Modules		Content	Types of academic activities
1.	Introduction.	The study of the physical basics for Earth Remote Sensing, the study of types and means for remote sensing. Remote sensing data processing software: a variety of GIS, QuantumGIS interface, loading raster data, vector layers creation, Openstreetmaps, satellite images, georeferencing. Rationale for the use of remote sensing data for the purposes of waste recycling	L, S
2	Basic principles of remote sensing, classification of remote sensing methods	Photointerpretation. photointerpretation signs. Features of recognition of artificial and natural objects. Semi-automatic classification. Multispec	L, S
	Methods for solving problems using remote sensing and GIS tools	Remote sensing data processing software. GIS software Diversity Types of problems solved with the help of GIS, Spatial analysis of GIS, a method for analyzing hierarchies.	L, S
3		Vegetation indices, groups of vegetation indices	L, S

Title of Course Modules		Content	Types of academic activities
	RSE methods to solve MSW tasks	Polygons. The main deciphering signs of unauthorized dumps. Methods for determining unauthorized dumps.	
4		Geoecomarketing	

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the course (if necessary)
Lecture	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office / Office 365, MS Teams, Chrome (latest stable release), Skype.
Seminars	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	Microsoft Windows 7 corporate. License No. 5190227, date of issue March 16, 2010 MS Office 2007 Prof , License # 6842818, date of issue 09/07/2009
Computer Lab	Computer Lab for conducting classes, group and individual consultations, current control and intermediate certification, equipped with personal computers (in the amount of 12), a board (screen) and technical devices of multimedia presentations.	QuantumGIS, Multispec
For Self-Study	Classroom for self-study (can be used for seminars and consultations), equipped with a set of devices includes laptop, stable wireless.	No

7. RECOMMENDED SOURCES FOR COURSE STUDIES

a) Main reading:

1. Editors: John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, 2001. Manual of Geospatial Science and Technology, November 2001, Vol 1 Part 1and II.

2. Martin Wegmann , Jakob Schwalb-Willmann , Stefan Dech An Introduction to Spatial Data Analysis: Remote Sensing and GIS with Open Source Software (Data in the Wild) 1st Edition, Kindle Pelagic Publishing, 2020
3. E.O. Wilson , Dawn J. Wright , Christian Harder GIS for Science, Volume 3: Maps for Saving the Planet. Esri Press, 2021, \$228
4. Jindong Li Satellite Remote Sensing Technologies Springer, Singapore, Space Science and Technologies, 2021, 421 rub
5. Remote Sensing and Image Interpretation, 7th Edition, [Thomas Lillesand](#) , [Ralph W. Kiefer](#) , [Jonathan Chipman](#) , \$ 736
6. List of available Indices Index DataBase A database for remote sensing indices. URL: <https://www.indexdatabase.de/db/i.php>
7. Suarez Kozov N. Application of **remote sensing** for monitoring of flood areas (Application remote sounding for monitoring zones flooding): article on the English language / KN Suarez, OD Trujillo, OJ Giraldo// Bulletin Russian university friendship peoples : Engineering research . - 2019. - No. t . 20(1). - S. _ 66 - 78. - ISSN 18230.
8. Ujaval Gandhi End-to-End Google Earth Engine (Full Course Material) A hands-on introduction to applied remote sensing using Google Earth Engine. <https://courses.spatialthoughts.com/end-to-end-gee.html>
9. Otto Huisman and Rolf A. de By Principles of Geographic Information Systems An introductory textbook The International Institute for Geo-Information Science and Earth Observation (ITC), webapps.itc.utwente.nl
10. Jonathan Campbell, Michael Shin, UCLA Essentials of Geographic Information Systems, Publisher: [Saylor Foundation](https://open.umn.edu/opentextbooks/formats/249) <https://open.umn.edu/opentextbooks/formats/249>

b) **Additional reading**

1. T. Takagi, T. Oguchi, J. Matsumoto, MJ Grossman, MH Sarker, MA Matin (2007) Channel braiding and stability of the Brahmaputra River, Bangladesh, since 1967: GIS and remote sensing analyses, *Geomorphology* 85, 294–305.
2. John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, (Editors), 2001. Photogrammetric and remote sensing considerations; Chapter 16, *Manual of Geospatial Science and Technology*, Vol 1 Part 4 Pages 233 – 252
3. John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos (Editors), 2001. The remote sensing process: how do we collect the required in situ and remotely sensed data? Chapter 17, *Manual of Geospatial Science and Technology*, November 2001, Vol 1 Part 4 Pages 253 – 275K.
4. *Manual of Remote Sensing: American Society of Photogrammetry and Remote Sensing.*
5. George Joseph: *Fundamentals of Remote Sensing*; Universities Press India Pvt Ltd, Hyderabad, India
6. Editors: John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, 2001. *Manual of Geospatial Science and Technology*, November 2001, Vol 1 Part 1 and II.
7. Paul M. Mather, 1999. *Computer Processing of Remotely Sensed Images: An Introduction*. John Wiley
8. T. Takagi, T. Oguchi, J. Matsumoto, MJ Grossman, MH Sarker, MA Matin (2007) Channel braiding and stability of the Brahmaputra River, Bangladesh, since 1967: GIS and remote sensing analyses, *Geomorphology* 85, 294–305.

b) databases, information and reference and search systems, Internet sources:

1. Interregional public organization for promoting the development of the market for geoinformation technologies and services Web site of the GIS Association: <http://www.gisa.ru>
2. Association of developers, manufacturers and consumers of equipment and applications based on global navigation satellite systems "GLONASS / GNSS-Forum": <http://aggf.ru/>

3. Intersectoral journal of navigation technologies Vestnik GLONASS: <http://vestnik-glonass.ru/>
4. State and prospects of the Russian satellite navigation market in 2010: an analytical review. – M: 2011 http://aggf.ru/analitika/AGGF_2011.pdf
5. Introduction to geoinformation systems / Web-site "GIS-Lab and authors" (<http://gis-lab.info/docs/giscourse>), Aug. 2007
6. Basic GIS - RECOD platform. <http://ssc.rekod.ru/content/services/3>

Internet-based sources

1. ELS of RUDN University and third-party ELS, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System - RUDN EBS <http://lib.rudn.ru/MegaPro/Web>
- ELS "University Library Online" <http://www.biblioclub.ru>
- EBS Yurayt <http://www.biblio-online.ru>
- ELS "Student Consultant" www.studentlibrary.ru
- EBS "Lan" <http://e.lanbook.com/>
- EBS "Trinity Bridge"

2. Databases and search engines:

- electronic fund of legal and normative-technical documentation <http://docs.cntd.ru/>
- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- abstract database SCOPUS [http:// www .elsevierscience.ru/ products / scopus /](http://www.elsevierscience.ru/products/scopus/)

8. MID-TERM ASSESSMENT AND EVALUATION TOOLKIT

Evaluation materials and a point- rating system* for assessing the level of competence formation (part of competences) based on the results of mastering the discipline **Remote Sensing of MSW objects** are presented in the Appendix to this course syllabus.

DEVELOPER:

Associate Professor of the NM
Department



Kapralova D.O.

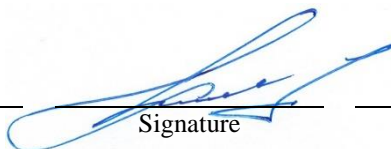
Position

Signature

Name, Surname

HEAD OF DEPARTMENT:

Director of the NM Department



Kucher D.E.

Position

Signature

Name, Surname

HEAD OF PROGRAMME:

Senior Lecturer of the ES&PQM
Department



Popkova A.V.

Position

Signature

Name, Surname

Department Environmental Management

APPROVED

Department meeting protocol No _____,

Dated _____

day, month, year

Head of Educational Department

_____(Kucher D.E.)

signature

ASSESSMENT TOOLKIT

for the course

Remote Sensing of MSW objects

course title

05.04.06 "Ecology and nature management"

field of studies / speciality code and title

«Integrated Solid Waste Management» (Network program with L.N. Gumilyov Eurasian National University)

higher education programme profile/specialisation title

master

graduate's qualification (degree)

GC-7 GPC-3 GPC -5 PC-5	Basic principles of remote sensing, classification of remote sensing methods	Photointerpretation. photointerpretation signs. Features of recognition of artificial and natural objects. Semi-automatic classification. Multispec	1		15	1		3	20	20
GC-7 GPC-3 GPC -5 PC-5	Methods for solving problems using remote sensing and GIS tools	Remote sensing data processing software. GIS software Diversity	2		15	2		3	22	22
		Types of problems solved with the help of GIS,								
	Spatial analysis of GIS, a method for analyzing hierarchies.									
RSE methods to solve MSW tasks		Vegetation indices, groups of vegetation indices	1		10	1	5	3	20	20
		Polygons. The main deciphering signs of unauthorized dumps. Methods for determining unauthorized dumps.								
		Geocomarketing20								
Total			5	10	60	5	5	15	100	100

Passport to Assessment Toolkit for Course Remote Sensing of MSW objects

QUESTION CARD No 1

QUESTION 1 Application of remote sensing data for waste management purposes

QUESTION 2 Classification of objects by image contrast

Developer _____ (Kapralova D.O.)
signature

Head of Educational Department _____ (Kucher D.E.)
signature

day, month, year

Pass/Fail assessment QUESTIONS

1. Direct deciphering signs.
2. Factors affecting the tone (brightness) of the image.
3. Calculating the size of an object from its shadow.
4. Ways to determine the scale of the image.
5. Types of object shape.
6. Classification of objects by image contrast.
7. The concept of the structure of the image. Structure types.
8. The concept of image texture. Image texture types.
9. Generalization during decryption.
10. Application of remote sensing data for waste management purposes
12. Name the groups of deciphering features.
13. On the identification of what regularities is the use of indirect signs of interpretation based?
14. What are the objects of landscape mapping?
15. Direct deciphering signs.
16. Calculation of the size of an object by its shadow.
17. Ways to determine the scale of the image.
17. Types of object shape.
19. Classification of objects by image contrast.
20. The concept of image structure. Structure types.
20. The concept of image texture. Image texture types.
- 21) The main technical factors affecting the information content of satellite images are
- 22) Atmospheric windows, what is it
- 23) The spectral channels
- 24) Supervised/unsupervised photointerpretation

Note * Practice case/task inclusion is subject to the teacher's discretion.

The set of exam question cards is complemented by the assessment criteria developed by the teacher and approved at the department meeting.

Assessment criteria:

(in compliance with the legal regulations in force)

Test question examples

- 1) The main technical factors affecting the information content of satellite images are
 - Composition of the atmosphere
 - Used equipment
 - country of satellite origin
 - Orbit type (or flight altitude)
 - Presence of clouds
 - shooting season
- 2) Atmospheric windows are:
 - parts of the electromagnetic spectrum that are not absorbed by the atmosphere
 - parts of the electromagnetic spectrum that are absorbed by the atmosphere
 - parts of the electromagnetic spectrum that the atmosphere reflects
 - territories of countries over where satellites can shoot
- 3) The spectral channel is:
 - Set of intervals of the electromagnetic spectrum
 - The interval at which the sensor is set to take a picture
 - Full interval of all existing wavelengths of electromagnetic radiation
- 4) Radiometric properties of aerospace images characterize
 - The amount of radio radiation of objects
 - The ability of images to reproduce small details and colors of the scene
 - Wavelength when shooting
- 5) When using active methods of remote sensing
 - the satellite sends a signal of its own energy source to Earth
 - the satellite registers the reflection of radiation
 - satellite turns on by itself

Laboratory works tasks

- 1) Working with rasters - binding, cropping, assembly, drawing up a 3D model based on, building a profile
- 2) Counting points in polygons, building thematic maps and editing them (graded sign, 2.5d, diagrams)
- 3) OSM, using OpenStreet Services
- 4) Vegetation indices, NDVI calculation
- 5) Determination of changes in time
 - vectorization of NDVI, determination of the difference,
 - sample raster values on the layer with NDVI, plotting based on the values of random points over the years)
- 6) Supervised/unsupervised classification in Multispec
- 7) Semi-automated search for landfills - a combination of work in Multispec and QGIS
- 8) Geocomarketing

Example of Lab work task

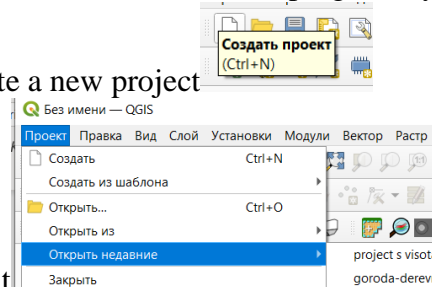
Lab #1: Introduction to the Quantum Interface GIS interface (version 3.22)

Toolbars and basic menu commands

The purpose of the work : to get an idea about the Quantum software product GIS 3.22. Explore the main features of the program. *Tasks*:

1. Launching the program and opening attribute tables.
2. Acquaintance with the main toolbars, menu commands and their purpose.
 - 1) Open the QGIS 3.22 folder, run the program by clicking on QGIS Desktop 3.22.4

2) You can create a new project



or open recent

- 3) The three main toolbars in QGIS contain buttons representing the most commonly used commands, procedures, and tools.
- 4) 
- 5) You can enable additional panels by right-clicking on an empty space in the top panel. Connected panels are visible in the list that appears.

Assessment criteria:

(in compliance with the legal regulations in force)

The assessment of all results of mastering competencies is carried out in accordance with the scale of the international point-rating system ECTS. In accordance with the calculated grading system, the student gains the required points.

Work in class: depends on the complexity of the topic.

The grade is given for attendance and active work at a seminar or lecture (lectures are held in an interactive form) - answers to current questions, notes, discussion. The student is present at the lesson, participates in the discussion, does not hesitate to answer questions - maximum score. The student is absent or the task is not prepared - 0 points.

Lab works – work is done – 5 points, laboratory work is not completed – 0 points.

Tasks of Self-studies: - acquisition of skills of independent practical work in the recommended software and application of various research methods; - developing the ability to independently and critically apply the material being studied. The SR technology should ensure the acquisition of knowledge, the consolidation and systematization of knowledge, the formation of skills and abilities. The proven technology is characterized by an algorithm that includes the following logically related student actions: - reading a text (textbook, manual, lecture notes); - note-taking of the text; - problem solving and exercises; - answers to control questions;

Final certification: A student is considered to have successfully passed the milestone or final certification if the total score for all activities at the time of certification exceeds 50% of the maximum possible score (lecture work, practical assignment, tests).

The final grade for the semester is added up as the sum of points for all types of student activities (*see toolkit passport) and can reach a maximum of 85 points, the article as obligatory for excellent mark.

The final test is given by the student voluntarily, if he scored the minimum possible score for certification - 51 points. In other cases, the test is mandatory and is estimated at a maximum of 10 points, as a result, the total score is derived taking into account the result of passing the test and the final grade corresponds to the international ECTS scale.

Tentative list of assessment tools

II / II	Assessment tool	Brief features	Assessment tool representation in the kit
<i>Class work</i>			
2	Test	A system of standardised tasks that allows the teacher to automate the procedure for measuring the student's level of knowledge and skills	Tests bank
4	Control work	A tool of control organised as a classroom lesson, at which students need to independently demonstrate the acquisition and mastering of the educational material of the course topic, section, or sections.	Questions on the course topics /modules
5	Lab work	The system of practice tasks aimed at the students' practical skills formation	Practice tasks bank
10	Pass/Fail assessment	A tool for checking the quality of students' performance of laboratory work, acquisition and mastering of the practice training and seminar educational material, successful completion of the advanced field internship and pre-graduate internship and fulfillment of all training assignments in the course of these internships in accordance with the approved programme.	Tasks examples
11	Exam	The evaluation of the student's work during the semester (year, the entire period of study, etc.); it is designed to identify the level, soundness and systematic nature of theoretical and practical knowledge gained by the student, formation of independent work skills, development of creative thinking, ability to synthesise the acquired knowledge and apply it to solve practice tasks.	Examples of tasks/questions/exam question cards
14	Multi-level tasks and assignments with varying difficulty	The tasks and assignments differ in terms of the following levels: a) reproductive level allows the teacher to evaluate and diagnose the students' knowledge of factual material (basic concepts, algorithms, facts) and the students' ability to correctly use special terms and concepts, recognize objects of study within a certain section of the discipline, b) reconstructive level allows the teacher to evaluate and diagnose the students' abilities to synthesise, analyse, generalise factual and theoretical material and formulate specific conclusions, establish cause-and-effect relationships, c) creative level allows to evaluate and diagnose students' skills to integrate knowledge of various fields, argue their own point of view.	Set of multi-level tasks and assignments with varying difficulty
<i>Self- studies</i>			
8	Homework	The tasks and assignments differ in terms of the following levels:	Set of multi-level tasks and

	<p>a) reproductive level allows the teacher to evaluate and diagnose the students' knowledge of factual material (basic concepts, algorithms, facts) and the students' ability to correctly use special terms and concepts, recognize objects of study within a certain section of the discipline,</p> <p>b) reconstructive level allows the teacher to evaluate and diagnose the students' abilities to synthesise, analyse, generalise factual and theoretical material and formulate specific conclusions, establish cause-and-effect relationships,</p> <p>c) creative level allows the teacher to evaluate and diagnose students' skills to integrate knowledge of various fields, argue their own point of view.</p>	assignments with varying difficulty
--	--	-------------------------------------

Criteria for assessing students' knowledge

Points BRS	Traditional grades in the Russian Federation	Points for transferring grades	Grades	ECTS grades
86 - 100	5	95 – 100	5+	A
		86 – 94	5	B
69 - 85	4	69 – 85	4	C
51 - 68	3	61 - 68	3+	D
		51 - 60	3	E
0 - 50	2	31 - 50	2+	FX
		0 - 30	2	F

Explanation of the rating table:

A	“Excellent” - the theoretical content of the course is mastered completely, without gaps, the necessary practical skills for working with the mastered material are formed, all the training tasks provided for by the training program are completed, the quality of their implementation is estimated by a number of points close to the maximum.
B	“Very good” - the theoretical content of the course is mastered completely, without gaps, the necessary practical skills for working with the mastered material are basically formed, all the training tasks provided for by the training program are completed, the quality of most of them is estimated by a number of points close to the maximum.
C	“Good” - the theoretical content of the course has been mastered completely, without gaps, some practical skills in working with the mastered material are not sufficiently formed, all the training tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks have been completed with errors.

D	“Satisfactory” - the theoretical content of the course has been partially mastered, but the gaps are not significant, the necessary practical skills for working with the mastered material are basically formed, most of the training tasks provided for by the training program have been completed, some of the completed tasks may contain errors.
E	“Mediocre” - the theoretical content of the course is partially mastered, some practical work skills are not formed, many training tasks provided for by the training program are not completed, or the quality of some of them is estimated by a number of points close to the minimum.
FX	“Conditionally unsatisfactory” - the theoretical content of the course has been partially mastered, the necessary practical skills have not been formed, most of the training tasks provided for by the training program have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the implementation of educational tasks.
F	“ Definitely unsatisfactory” - the theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all the completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the training tasks.