MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
IVANO-FRANKIVSK NATIONAL TECHNICAL UNIVERSITY OF OIL AND GAS

Institute of Petroleum Engineering

«APPROVED»
Head of the Methodological Council of IFNTUOG

_____ **Serhiy ZIKRATYI**
(signature) (First name Surname)

«30» 08 2024 year

SYLLABUS

MATERIALS AND CHEMICAL REAGENTS FOR OIL AND GAS PRODUCTION

Educational level Bachelor

Type of discipline Selected from the university catalog

Language of teaching English

2024 y.

The work program is developed for students _____ *all specialties* _____ specialties
(code and name of the specialty)

Developer:
Teacher of the **Department of Petroleum Production**
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Approved at the meeting of the Petroleum Production Department
Protocol on «30» August 2024 y. № 1

Head of the department
Petroleum production, Ph.D., associate professor **Liliia MATIISHYN**

Coordinated:

Head of the educational department **Ihor SHOSTAKIVSKYI**

1 GENERAL INFORMATION ABOUT THE EDUCATIONAL DISCIPLINE

The purpose and tasks of the discipline	The purpose of teaching the educational discipline "Materials and chemical reagents for oil and gas production" is to provide the knowledge by students of materials and chemical reagents used in drilling and exploitation of wells, the intensification of industrial production and preparation of hydrocarbons and application of methods to increase oil and gas production, their properties and parameters that characterize them and to study the physical and chemical properties and parameters of formation fluids, gases and gas condensate mixtures.
The link of placing the discipline on the educational platform	https://nung.edu.ua/department/kafedra-vydobuvannya-nafty-i-hazu/osvitni-prohramy
Preliminary requirements for studying the discipline (prerequisites)	Fundamentals of ecology in oil and gas industry
Postrequisites	Technology of increasing oil and gas condensate recovery from reservoirs
Learning results	PH9. Apply basic concepts and methods of fundamental and applied sciences to solve specialized tasks in oil and gas engineering. PH10. Predict and analyze the physicochemical properties of oil and gas in the processes of their production, transportation and storage.
Competencies	CK9. Ability to solve production and technological problems in drilling wells, production, transporting and storing oil and gas. CK11. Ability to carry out technological and technical and economic evaluation of the effectiveness of new oil and gas technologies and technical devices.
Final control, form	Exam
The list of social, "soft skills"	Sociability; logical thinking; positive thinking; self-discipline and self-control; desire to learn and to develop constantly, complex problem solving, critical thinking for formation of one's own opinion and decision making, etc.

2 POLICY OF EDUCATIONAL DISCIPLINE

1) regarding attendance at classes and behavior at them

According to the "Regulations on the Organization of the Educational Process at the Ivano-Frankivsk National Technical University of Oil and Gas" (https://salo.li/00e7FDf) attendance for acquirers of higher education of all auditorium classes according to the valid schedule during the semester is mandatory. Attendance and lateness do not have a direct impact on the scoring system, however, in case of systematic absences for classes and non-fulfillment of scheduled assessed activities (testing, practical works), the teacher reserves the right to report this case to the directorate of the institute in the written form.

During lectures, the use of mobile phones, laptops and tablets is allowed for viewing presentation and text components of lecture materials. During practical classes, it is allowed to use phones and tablets to view presentation materials, as well as own laptops to perform practical works and demonstrate the results of work during the defense.

The acquirer's activity on lectures and the ability to ask questions about the topic of the lecture to the teacher are welcomed.

In the case of a class carrying out using distance learning tools, access to the video conference is carried out exclusively from a corporative e-mail account for the purpose of identifying the acquirer of higher education. In the case that practical work defenses take place using distance learning tools, the acquirer must turn on video communication during the defense of the work.

2) regarding compliance with the principles of academic integrity

Education acquirers are obliged to comply strictly with the "Regulations on academic integrity of employees and acquirers of higher education of the Ivano-Frankivsk national technical University of oil and gas" (from April 5, 2022, order No. 73). In particular, perform independently auditorium tasks, control tests, do not falsify their study results; avoid writing off, do not use other people's tips during ongoing knowledge control activities; follow correctness in references to sources of information in case of borrowing information, statements and ideas.

3) regarding evaluation

In condition of the completion of all practical works, completion of two colloquiums based on the results of the lecture course and confirmation of mastery of the minimum level of learning results (at least 60 points on the ECTS scale per semester) the acquirer of higher education is admitted to the semester control of the discipline. The form of semester control is credit.

Additional points are given for the preparation of reviews of scientific works, presentations on one of the topics of self-content work of students on the discipline, for performance of additional tasks, etc. The quantity of additional points is not more than 10.

In the case of the use of on-line (distant) learning technology, current and semester control are carried out in accordance with the "Regulation on the organization of current, semester control and attestation of acquirers of higher education using on-line technologies" from 22.102022 y. (order n. 262).

4) regarding deadlines and reexamination

Completed practical work must be defended/submitted at the beginning of the next practical class. For each week of delay in submitting a report on practical work, a penalty (–1) point is calculated, but the sum is not more than –2 for one practical work.

The conditions of admission to the reexamination of modular and final control, the schedule and forms of reexamination are regulated by the Regulation on the organization of the educational process in IFNTUOG, specified in point 1) of this section.

5) regarding the recognition of learning results in non-formal education

The results of non-formal education can be recognized and recredited as part of the evaluated activities, according to the REGULATION on the procedure for recognizing the results obtained in non-formal and informal education in IFNTUOG (https://griml.com/Ew5zh) in the case of presentation of a certificate of successful completion of the course (with the indicated grade) and in the event that the topics of the on-line course, training, course correspond to the educational elements of the discipline.

6) regarding appeal of the results of control measures

The appeal is carried out in accordance with the Regulation on appeals by acquirers of higher education on issues related to the educational process, approved by the order of the rector of the university n. 43 dated 24.02.2020 y. One can be familiarized with the document by the link https://griml.com/L3VUV..

7) regarding conflict situations

Communication between the participants of the educational process (teachers, acquirers) takes place on the basis of partnership relations, mutual support, mutual respect, tolerance and respect for each person's personality, aimed at acquiring true knowledge. The resolution of conflict situations is carried out in accordance with the Regulation on the resolution of conflict situations in IFNTUOG, approved by the order of the rector of the university n. 44 from 24.02.2020y. One can be familiarized with the document by the link https://griml.com/i42PI.

8) regarding the survey of acquirers

After completing the course, the acquirer is given the opportunity to take a survey about the quality of teaching the discipline by the link https://nung.edu.ua/department/yakist-osviti/04-anketuvannya

3 STRUCTURE OF THE ACADEMIC DISCIPLINE "MATERIALS AND CHEMICAL REAGENTS FOR OIL AND GAS PRODUCTION"

3.1 Volume of the academic discipline

The resourse of hours for the studying the discipline "Materials and chemical reagents for oil and gas production" according to the current Studying Plan, the distribution by semesters and types of educational work for various forms of education is characterized by Table 1.

Table 1 – Distribution of hours intended for the study of the discipline "Materials and chemical reagents for oil and gas production"

Name of indices	Total	Distribution by semesters	
		Semester 7	Semester __
Number of credits ECTS	5	5	
Number of modules	2	2	
Total amount of time, hours	150	150	
Auditorium classes, hours, including:	58	58	
lecture classes	22	22	
seminar classes	-	-	
practical classes	36	36	
laboratory classes	-	-	
Self-content work, hours	92	92	
The form of semester control	Exam	Exam	

3.2 The thematic plan of lecture classes

The thematic plan of lecture classes of the discipline "Materials and chemical reagents for oil and gas production" is characterized by Table 2.

Table 2 – The thematic plan of lecture classes

Code	Names of modules (M), content modules (CM) and topics (T)	Amount of hours	References
			Number
M1	**Characteristics, mechanism of action and application technology of materials and chemical reagents in oil and gas production**	**18**	
CM1	**Materials and chemical reagents which are used during well drilling, formation exposing and development of productive formations (well completion)**	**4**	
T 1.1	Introduction. State and prospects of oil and gas in the world and in Ukraine. Modules and content modules of the discipline	1	10, 1c
T 1.2	Well drilling and reagents used for preparation of drilling muds	1,5	3, 9, 12
T 1.3	Cementation of wells and reagents used for preparation of washing and plugging-back solutions	0,5	3, 9, 12
T 1.4	Productive formations exposing and reagents used in this process	0,5	3
T 1.5	Wells completion and reagents used in this process	0,5	3

Code	Names of modules (M), content modules (CM) and topics (T)	Amount of hours	References
			Number
CM2	**Materials and chemical reagents used during wells operation for the increase of their productivity and in the system of treatment**	**10**	
T 2.1	Brief description of methods of wells operation and reagents which are used	1	1, 2, 3
T 2.2	The reasons of deterioration of bottom-hole formation zone and its influence on productivity of wells	0,5	1, 5, 6
T 2.3	Basic methods of intensification of oil and gas recovery and injectivity of injection wells and reagents which are used	1	1, 2, 5, 6
T 2.4	Acid action effect on the formation. Acids and components of the acid solution	1	5, 6
T 2.5	Methods of acid action and basic reagents for carrying out of them	1	5, 6, 11
T 2.6	Reagents used in hydraulic jet perforation and hydraulic fracturing of formation	1	5, 6, 11
T 2.7	The treatment of bottom-hole formation zone with surfactant solutions. Directed and selective methods of action upon the productive formation	0,5	1, 2, 5
T 2.8	Repair-isolating works and reagents used in this process. Limitation of water inflow into the wells and reagents used in this process	1	1, 2, 3, 13, 1п
T 2.9	Reagents which are used in the system of gathering and treatment of oil and gas and methods of their usage	1	2, 3, 9
T2.10	Complications in the process of wells operation and reagents used for prevention of their formation.	2	1, 2, 3, 8, 13
CM3	**The methods of increasing oil-, gas- and gas condensate recovery from formations and reagents used in these processes**	**4**	
T 3.1	The forces which operate in productive formations and oil and gas accumulation drives. Oil-, gas- and gas condensate recovery factor and general characteristics of the methods of its increasing	2	1, 2, 3, 7, 14, 15
T 3.2	Hydrodynamic and thermal methods of oil-, gas- and gas condensate recovery factor increase	1	1, 2, 3, 2п
T 3.3	Physico – chemical methods of oil-, gas- and gas condensate recovery factor increase	1	1, 2, 3, 2п
M2	**Environment protection during drilling and operation of wells**	**4**	
CM4	**Environment protection during drilling and operation of wells, in wells repair work and during treatment and storage of field production**	**4**	
T 4.1	Environment protection during wells drilling, productive formations exposing, their completion and testing, and during well remedial work and well workover	2	2, 4
T 4.2	Environment protection during wells operation and during carrying out works on intensification of fluids inflow into the well	1	2, 4

Code	Names of modules (M), content modules (CM) and topics (T)	Amount of hours	References
			Number
T 4.3	Environment protection during the treatment, storage and transportation of oil, gas and petroleum products	0,5	4
T 4.4	Environment protection during the usage of the methods of increasing oil-, gas- and gas condensate recovery from formations	0,5	4

Total:
Modules – 2, thematic modules – 4.

3.3 Themes of practical classes

The themes of practical classes of the discipline "Materials and chemical reagents for oil and gas production" are given in Table 3.

Table 3 – Themes of practical classes

Code	Themes of practical classes	Amount of hours	References
			Number
M1	**Characteristics, mechanism of action and application technology of materials and chemical reagents in oil and gas production**	**30**	
CM1	**Materials and chemical reagents which are used during well drilling, formation exposing and development of productive formations (well completion)**	**6**	
P 1.1	The main technological parameters and magnitudes characterizing materials and chemical reagents used in drilling and operation of wells and their dimensions	2	1п, 5п
P 1.2	Solving the problems on determining the required volume of reagents for the preparation of muds at different geological and geological and field comditions	2	1п, 5п
P 1.3	Solving the problems on the choice of fluids for productive formations exposing and their completion	2	1п, 5п
CM 2	**Materials and chemical reagents used during wells operation for the increase of their productivity and in the system of treatment**	**18**	
P 2.1	Solving the problems on determining the required volume of reagents for preparing acid solutions in acid action carrying out	4	2п, 5п
P 2.2	Solving the problems on determining the required volume of reagents during carrying out thermal acid and thermo-chemical treatments	2	5п
P 2.3	Solving the problems on determining the required volume of reagents during hydraulic fracturing of formations and hydraulic jet perforation	4	5п
P 2.4	Determining the required volume of materials and chemicals for the preparation of plugging-back solutions	2	5п
P 2.5	Determining the required volume of inhibitors for corrosion protection of oil and gas field equipment and hydrate inhibitors	2	5п
P 2.6	Solving the problems on the preparation of surfactant solutions, micellar solutions, alkali solutions and polymers	2	3п, 4п, 5п
P 2.7	Determining the required volume of demulsification agents in oil industrial treatment	2	3п, 5п

Code	Themes of practical classes	Amount of hours	References
			Number
CM 3	**The methods of increasing oil-, gas- and gas condensate recovery from formations and reagents used in these processes**	**6**	
P 3.1	Determining the required volume of reagents while implementing the methods for increasing oil-, gas-and gas condensate recovery for specific examples	2	2п, 3п, 5п
P 3.2	Solving the problems on determining the additional hydrocarbon production while implementing the methods for increasing oil-, gas- and gas condensate recovery using the characteristics of displacement	4	2п, 3п, 5п
M2	**Environment protection during drilling and operation of wells**	**6**	
CM 4	**Environment protection during drilling and operation of wells, in wells repair work and during treatment and storage of field production**	**6**	
P 4.1	Solving the problems on the safe conducting the geological and technical measures during the operation of wells and the increase of their productivity	6	5п

3.4 Laboratory classes

Laboratory classes are not provided.

3.5 Tasks for self-content work of student

The types of self-content work within the educational discipline "Materials and chemical reagents for oil and gas production" are given in Table 4.

Table 4 – Contents of self-content work

Name of indices	Total	Distribution by semesters	
		Semester _7_	Semester ___
Fulfilment of the course project	-	-	
Fulfilment of control (calculation and graphical) works	-	-	
Studying the material presented at the lectures	18	18	
Studying the material which is intended for self-content study	30	30	
Preparation for practical classes and control measures	14	14	
Preparation of reports on laboratory works	-	-	
Preparation for the examination	30	30	
Self-content work, hours	92	92	

The list of material submitted for self-content study is given in Table 5.

Table 5 – Material submitted for self-content study

Code	Names of modules (M), content modules (CM), questions submitted for self-content study	Amount of hours	References
			Number
M1	**Characteristics, mechanism of action and application technology of materials and chemical reagents in oil and gas production**	**80**	
CM1	**Materials and chemical reagents which are used during well drilling, formation exposing and development of productive formations (well completion)**	**16**	
T 1.2 – 1.4	Drilling of wells. Methods of drilling. Reagents used in wells drilling, productive formations exposing and their completion	16	3, 9, 12
CM 2	**Materials and chemical reagents used during wells operation for the increase of their productivity and in the system of treatment**	**34**	
T 2.1	Methods of operating production wells and their features	6	1, 2, 3, 1c
T 2.2	The reasons of deterioration of bottom-hole formation zone and its influence on productivity of wells	12	1, 5, 6
T 2.3 – 2.8	Methods for increasing productivity and injectivity of injection wells (types, short principle and peculiarities of usage)	10	1, 2, 3, 11, 13, 1c
T 2.9	The field systems of gathering and treatment of oil and gas	6	2, 3, 9, 3п, 1c, 2c
CM 3	**The methods of increasing oil-, gas- and gas condensate recovery from formations and reagents used in these processes**	**30**	
T 3.1 – 3.3	The forces which operate in productive formations and oil and gas accumulation drives. Oil-, gas- and gas condensate recovery factor, its general characteristics and the methods of its increasing	30	1, 3, 7, 1c, 2c
M2	**Environment protection during drilling and operation of wells**	**12**	
CM4	**Environment protection during drilling and operation of wells, in wells repair work and during treatment and storage field production**	**12**	
T 4.1 – 4.2	Environment protection during wells drilling, productive formations exposing, their completion and testing, and during well remedial work and well workover	6	2, 4, 1c, 2c
T 4.3 – 4.4	Peculiarities of environment protection during the gathering and treatment of well production and during the usage of methods for increasing oil-, gas- and gas condensate recovery	6	4, 1c, 2c

4 EDUCATIONAL AND METHODOLOGICAL PROVISION OF THE DISCIPLINE

4.1. Basic references

1. Boyko V.S. Handbook on oil and gas business / V.S. Boyko, R.M. Kondrat, R.S. Yaremiichuk; Ivano-Frankiv. national technical University of Oil and Gas. – Lviv, 1996. – 620 p.
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2. Akulshyn O.I. Technology of production, storage and transportation of oil and gas [Text] : Manual / O. I. Akulshyn, O. O. Akulshyn, V. S. Boyko [et al.]. – Ivano-Frankivsk : Fakel, 2003. – 434 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=73519.
3. Boyko V.S Development and operation of oil fields : Lecture book / V. S. Boyko. – K. : Real-Print, 2004. – 695 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=82138.
4. Petriashyn L. F. Protection of environment in oil and gas industry : Manual / L. F. Petriashyn, G. N. Lysianyi, B. G. Tarasov. – Lviv : Vyshcha school, 1984. – 188 p.
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5. Intensification of hydrocarbons inflow into the well. Book 1 / [Kachmar Yu.D., Svitlytsky V.M., Syniuk B.B., Yaremiichuk R.S.]. – Lviv : Centre of Europe, 2004. – 352 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=118376.
6. Intensification of hydrocarbons inflow into the well. Book 1 / [Kachmar Yu.D., Svitlytsky V.M., Syniuk B.B., Yaremiichuk R.S.]. – Lviv : Centre of Europe, 2005. – 414 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=118377.
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8. Malcolm A. Kelland. Production chemicals for the oil and gas industry, CRC Press (Taylor and Francis Group), 2009. – 404 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=452372
9. Havard Devold. Oil and gas production handbook. An introduction to oil and gas production. ABB, Oslo, 2006. ISBN 978-82-997886-1-8.
https://search.library.nung.edu.ua/DocDescription?doc_id=408491.
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11. Boyun, Guo. Petroleum Production Engineering. A Computer-Assisted Approach [Text] / Guo Boyun, C. Lyons William, Ghalambor Ali. – Gulf Professional Publishing, 2007. – 287 p. – ISBN 0750682701.
https://search.library.nung.edu.ua/DocDescription?doc_id=433665.

4.2 Additional references

12. Lyons W. Formulas and calculations for drilling, production, and workover [Text] / W. Lyons, T. Carter, Norton J. Lapeyrousse. – Oxford, 2012. – 293 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=472129.
13. Boyko V.S. Oil production in complicated conditions: a monograph / V. S. Boyko, R. V. Boyko, R. V. Hrybovskyi and others. – Ivano-Frankivsk: Nova Zorya, 2013. – 770 p.: – ISBN 978-966-398-090-4.
https://search.library.nung.edu.ua/DocDescription?doc_id=364800.
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https://search.library.nung.edu.ua/DocDescription?doc_id=408592.
15. Craft B. C. Applied petroleum reservoir engineering. / B. C. Craft, M. F. Hawkins ; revised by Terry R.E. – second edition. – USA : Prentice-Hall, Inc. – 431 p. – ISBN 0-13-039884-5.
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4.3 Literature and methodological support of practical classes

1п Boyko V.S. Operation of wells in unstable reservoirs : monograph / V. S. Boyko , I. A. Franchuk, S. I. Ivanov, R. V. Boyko. – K. : Knygodruck, 2004. – 400 p. ISBN 966-694-012-4.
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2п Boyko V.S. Technology of oil production: Lecture book. / V.S. Boyko, Ya.B. Tarko, Ya.S. Kotskulych – Ivano-Frankivsk: Publishing House "Nova Zoria", 2012. – 827 p.
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5п Moroz L. B. Materials and chemical reagents in Oil and Gas Industry [Text] : practice manual / L. B. Moroz, M. O. Psyuk. – Ivano-Frankivsk : IFNTUOG, 2021. – 61 p.
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4.4 Literature and methodological support of self-contained work

1с. Moroz L. B. Materials and chemical reagents in oil and gas production: guidance booklet. / L. B. Moroz. – Ivano-Frankivsk: IFNTUNG, 2013. – 19 p.
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2с. Moroz L. B. Materials and chemicals in oil and gas production [Text] : guidance booklet / L. B. Moroz, M. O. Psiuk. – Ivano-Frankivsk : IFNTUNG, 2018. – 23 p.
https://search.library.nung.edu.ua/DocDescription?doc_id=449477.

4.5 Information resources on the Internet

Electronic course Materials and chemicals in oil and gas production for distance learning. Ivano-Frangkivsk: IFNTUNG, 2018 (authored by Moroz L. B.).

5 FORMS AND METHODS OF LEARNING

Forms and methods of training and assessment within the time of passing discipline "Materials and chemical reagents for oil and gas production" are given in Table 6.

Table 6 – Provision of program learning results by appropriate forms and methods

Code of the program learning result	Teaching methods (TM)	Forms and methods of assessment (FMA)
Specialized conceptual knowledge incorporating current scientific advances in oil and gas engineering and technology for original thinking and research. Conduct theoretical and experimental studies of parameters and regimes of functioning of systems and technologies in the field of oil and gas engineering and technologies. Plan and carry out scientific research in the field of oil and gas engineering and technologies, choose methods and tools, formulate and check hypotheses, analyze results, substantiate conclusions.	TM 1.1 – lecture TM 1.2 – story-explanation TM 1.3 – conversation TM 2.1 – illustration TM 2.4 – multimedia methods TM 3.4 – practical works TM 18 – methods of self-content work at home; TM 19 – work under the guidance of the teacher. TM 20.1 – case method TM 20.7 – conversation-dialogue	FMA 1 – examination FMA 4 – current control FMA 8 – test control

6 METHODS OF CONTROL AND THE SCHEME OF CALCULATING POINTS

Assessment of knowledge of students is carried out based on the results of complex controls for two modules M1, M2. The modular control of each content module involves the control of theoretical knowledge and practical skills. The scoring scheme for assessing the knowledge of students on the discipline is given in Table 7.

The following methods and forms of assessment will be used during studying the discipline: current control (FMA 4), test control (FMA 8), form of final attestation – examination (FMA 1).

Table 7 – Scheme of awarding points in the process of assessing the knowledge of students on the discipline "Materials and chemical reagents for oil and gas production"

Types of works which are controlled	Maximum number of points
Control of learning the theoretical knowledge of the content modules CM1 – CM4 *МФО 4, 8	60
Control of learning practical knowledge on the content modules CM1 – CM4 *МФО 4, 8 (4×10)	40
Final mark on current control (Πo)	100
Examination mark (Io)	100
Final semester mark (Co)*	*Co* = (*Πo* + *Io*) / 2.

* - *explanation see Order of the rector of IFNTUOG "On coding of teaching methods, and methods and forms of assessment" n. 150 from June 24, 2021.*

The final assessment of the examination on discipline is conducted in accordance with the requirements of the current Regulation "On the system of current and final control, knowledge assessment and determination of rating of students".

Education acquirers can get additional points for the preparation of reviews of scientific works, presentations on one of the topics of self-content work of students on the discipline, for performance of additional tasks, etc. The quantity of additional points is not more than 10.

Total assessment of current control (Πo) – the sum of assessments of current control of acquirers, namely: results of control measures, performance of practical and other works provided for in the work program.

On condition of completion of all types of work provided for by the curriculum and program and confirmation of mastering at the minimum level of learning results (received 35 points on the ECTS scale), the acquirer of higher education is admitted to the semester control of the discipline in the form of an examination.

The examination mark (Io) is the quantity of points on an one hundred point scale that the acquirer received during the semester examination.

The final semester mark on the academic discipline (Co) is determined by means of the formula – Co = (Πo + Io) / 2.

For determination of the degree of mastery of the educational material and its subsequent assessment, the levels of educational achievements of higher education acquirers, given in Table 8, are used.

Table 8 – Levels of educational achievements

Levels of educational achievements	Percentage of points for completing tasks	Criteria of assessment of educational achievements	
		Theoretical training	Practical training
		Acquirer of higher education	
Excelent	*90…100*	is fluent in educational material, expresses his opinions, makes reasoned conclusions, reviews the answers of other acquirers, creatively performs individual and collective tasks; self-contently finds additional information and uses it for implementation of the tasks set before him; freely uses new information technologies to supplement his own knowledge	can reasonably choose a rational way of performing the task and evaluate the results of his own practical activity; performs tasks not provided for in the curriculum; freely uses knowledge to solve the tasks set before him
Sufficient	75…89	is fluent in educational material, applies knowledge in practice; summarizes and systematizes educational information, but allows minor disadvantages in comparisons, formulation of conclusions, application of theoretical knowledge in practice	according to the example, self-contently performs practical tasks provided by the program; has stable task performance skills
Satisfactory	60…74	knows the educational material superficially, fragmentarily, at the level of memorization reproduces a certain part of the educational material with elements of logical connections, knows the basic concepts of the educational material	has elementary, unstable task performance skills
Unsatisfactory	less than 60	has fragmentary knowledge (less than half) in an insignificant total amount of educational material; there are no developed skills and abilities; significant mistakes are made during the answer	plans and performs part of the task with the help of the teacher

The results of training on the discipline are assessed on a 100-point scale (from 1 to 100) with conversion to a rating on a traditional scale (“excellent”, “good”, “satisfactory”, “unsatisfactory” according to the scale shown in Table 9).

Table 9 – Assessment scale: national and ECTS

The sum of points for all types of educational activities	Mark on ECTS scale	Mark on a national scale
		for an exam, credit, course project (work), practice
90 – 100	**A**	excellent
82 – 89	**B**	good
75 – 81	**C**	
67 – 74	**D**	satisfactory
60 – 66	**E**	
35 – 59	**FX**	unsatisfactory with the possibility of reexamination
0 – 34	**F**	unsatisfactory with mandatory restudying of the discipline

7 TEACHING TOOLS

In the conditions of off-line studying, the teacher uses equipment for multimedia presentations: a multimedia projector, a projection screen, a laptop. There are no requirements for education acquirers regarding the availability of equipment.

In the conditions of studying using distant technologies, a laptop, personal computer or mobile device (phone, tablet) with an Internet connection, a video camera and a microphone is required. Educational classes on the discipline are conducted using the Google Meet and Google ClassRoom platforms.