Ministry of Science and Higher Education of the Russian Federation

Federal State Budgetary Educational Institution of Higher Education
Perm National Research Polytechnic University

APPROVED BY
Pro-rector for Academic Affairs
_____ N.V. Lobov
25 03 2021

ACADEMIC COURSE WORKING PROGRAM

Academic course: Well production and surface facilities engineering
(Name)

Form of education: Full-time
(Full-time /full-time – correspondence/correspondence)

Level of higher education: Bachelor's degree
(Bachelor's program/specialist program/
Master's program)

Workload in hours (in credits): 252 (7)
(Hours (CU))

Training program (degree): 21.03.01 Oil and Gas Engineering
(Code and denomination of degree)

Direction: Oil and Gas Engineering
(Title of curriculum)

Perm 2021

1. GENERAL PROVISIONS

1.1. GOALS AND OBJECTIVES OF THE COURSE

The goal of the course is the acquisition by students of knowledge and skills in the operation of wells and surface facilities.

The objectives of the course are:

- to form the knowledge necessary for professional operation and injection wells, oil, gas and water collection and treatment systems.
- to develop skills in monitoring the operation of fields and wells, oil, gas and water gathering and treatment systems.
- to develop skills for adjusting the technological modes of operation of wells, oil, gas and water collection and treatment systems.
- to develop skills in the selection of suitable configuration equipment for wells, oil, gas and water gathering and treatment systems.

1.2. STUDIED OBJECTS OF THE COURSE

Technical documentation in the field of hydrocarbon production; technologies for operation of injection and production wells, oil, gas and water collection and treatment systems; equipment for the operation of injection and production wells, oil, gas and water gathering and treatment systems; purpose, device and principle of operation of equipment for the extraction of hydrocarbons; physical and chemical properties of hydrocarbon raw materials, chemical reagents; methods for assessing the performance of wells, oil, gas, water gathering and treatment systems.

1.3. STARTING CONDITIONS

Unstipulated

2. PLANNED RESULTS OF THE COURSE TRAINING

Compe-tence	**Indicator's Index**	**Planned Results of the Course Training (to know, to know how, to master)**	**Indicator of Attaining Competence which the planned results of training are correlated with**	**Means of Assessment**
1	**2**	**3**	**4**	**5**
PC-1.5	**IA-1$_{pc-1.5.}$**	**To know** structure and methods of reporting; technical documentation for the operation of technical devices that are part of the well, wellhead equipment; regulatory and limiting parameters of equipment for the extraction of hydrocarbons	**Knows** types of technological and industry documentation and requirements for them; types and requirements for accounting, basic accounting instruments, terms of accounting, algorithms of accounts formation.	Exam

1	2	3	4	5
PC-1.5	**IA-2$_{pc-1.5.}$**	Be able to: – develop an action plan for the study of wells and oilfield equipment	**Can** form the request for field research and materials.	Practical report
PC-1.5	**IA-3$_{pc-1.5.}$**	**To master the skills** in accounting for the availability and condition of equipment for the production, collection and preparation of hydrocarbons; in checking the operation of equipment for the production, collection and preparation of hydrocarbons	**Masters the skill of** industry document and accounting maintenance.	Course project
PC-2.3	**IA-1$_{pc-2.3}$**	**To know** advanced repair technologies, progressive methods and techniques of labor; purpose, device and principle of operation of equipment for the extraction of hydrocarbons; technological processes for the extraction of hydrocarbons	**Knows** methods of organizing technological processes operation at oil-and-gas complex.	Exam
PC-2.3	**IA-2$_{pc-2.3}$**	**To be able to** draw up action plans to fulfill planned targets for the production of hydrocarbon raw materials; to prepare draft long-term, annual and monthly plans for the production of hydrocarbon raw materials, for the use of hydrocarbon raw materials for own needs and the estimated losses of hydrocarbon raw materials; to coordinate rationalization activities	**Is able to** apply knowledge concerning technological processes of O&G complex aimed at organization of employees' work; make performing decisions in case of convergence of opinion and conflict of interests; determine work procedure; organize and monitor O&G complex operation; coordinate the work of gathering field data.	Course project
PC-2.3	**IA-3$_{pc-2.3}$**	**To master the skills** to control the implementation of maintenance schedules for wellhead equipment, piping, oil and gas field pipelines, prefabricated pipelines, gas pipelines-loops, inhibitor pipelines and valves	**Master the skill** of organizing operational management of technological processes in accordance with the chosen sphere of professional activity.	Practical report
PC-3.2	**IA-1$_{pc-3.2.}$**	**To know** advanced technologies in the operation of well equipment and oil field systems; advanced energy-saving technologies in the operation of equipment for the extraction of hydrocarbons.	**Knows** general directions of research in O&G industry.	Exam

1	2	3	4	5
PC-3.2	**IA-2$_{pc-3.2.}$**	**To be able to** analyze the actual and predicted parameters of the reservoir-well system, submersible pumping equipment of the production gathering system; formulate proposals for the introduction of advanced technologies in the operation of well equipment and oilfield systems	**Is able to** substantiate the urgency and goals of own research with their further representation at the conferences and seminars; make scientifically-grounded reports on the problems of O&G industry.	Course project
PC –3.2	**IA-3$_{pc-3.2.}$**	**To master the skills** of presenting measures for the prevention and elimination of accidents and incidents in the production of hydrocarbons; in presenting proposals for improving the efficiency of equipment for wells and oilfield systems	**Masters** the methods of presenting the results of own research in the form of electronic presentation.	Practical report
PC-4.1	**IA-1$_{pc-4.1.}$**	**To know** the procedure for calculating the performance of a production well using software products; advanced energy-saving technologies in the operation of equipment for the extraction of hydrocarbons	**Knows** the mechanism and technology of designing technological processes, technological complexes used in production, in particular, systems of supervisory control (monitoring), geological and technical control, and etc., standard computer programs for calculation of engineering tools and technological decisions.	Exam
PC-4.1	**IA-2$_{pc-4.1.}$**	**To be able to** analyze the technical parameters of equipment for the extraction of hydrocarbons; analyze the performance of wells and oilfield systems; analyze the volumes of hydrocarbon production; analyze the effectiveness of the measures taken to fulfill the tasks for the extraction of hydrocarbons; analyze the reasons for deviations of the operating parameters of hydrocarbon production facilities from the norms of technological parameters	**Is able to** analyze and summarize the experience of designing engineering and technological projects, apply standard software at designing production and technological processes in O&G industry.	Laboratory work

1	2	3	4	5
PC-4.1	**IA-3$_{pc-4.1.}$**	**To master the skills** in the development of technical documentation for the operation of technical devices that are part of the well, wellhead equipment of the well and oil field systems	**Masters the skill** of designing definite sections of engineering and technological projects.	Course project
PC –4.2	**IA-1$_{pc-4.2.}$**	**To know** requirements of technical documentation in the field of hydrocarbon production; industry standards, technical regulations, manuals (instructions) that establish requirements for the operation of equipment for the extraction of hydrocarbons; requirements of regulatory documents in the field of accidents and incidents accounting; requirements for the preparation of project documentation	**Knows** regulations, standards, standing instructions, methods of designing in O&G industry.	Exam
PC-4.2	**IA-2$_{pc-4.2.}$**	**To be able** to prepare proposals for the modernization and reconstruction of operating equipment for the extraction of hydrocarbons, develop test programs; develop plans for the introduction of new equipment, advanced technologies, research and development projects aimed at improving the reliability of equipment for the extraction of hydrocarbons; analyze operational and technical documentation for the operation of equipment in the production of hydrocarbon raw materials; develop production and technical documentation for the implementation of planned targets for the production of hydrocarbon raw materials by divisions	**Is able to** develop standard designs, technological and working papers with the use of CAD of technological processes.	Practical report
PC-4.2	**IA-3$_{pc-4.2.}$**	**To master the skills** of reading technological schemes, drawings and technical documentation; of using specialized software products; in predicting optimal well production rates; in determining technological losses of hydrocarbon raw materials during production in accordance	**Masters** innovative methods for solving the tasks of technological and production processes design in O&G industry.	Course project

1	2	3	4	5
		with the adopted scheme and technology of field development; in developing measures to optimize hydrocarbon production; in predicting the occurrence of complications in the production, collection and treatment of oil, gas and water; in drawing up plans for the production of hydrocarbons, the use of hydrocarbons for own needs		

3. FULL TIME AND FORMS OF ACADEMIC WORK

Form of academic work	Hours in all	Distribution in hours according to semesters
		Number of semester
		7
1. Holding classes (including results monitoring) in the form: 1.1.Contact classwork, including:	83	83
– lectures (L)	45	45
– laboratory work (LW)	18	18
– practice, seminars and/or other seminar-type work (PW)	18	18
– control of self-work (CSW)	2	2
– test		
1.2. Students' self-work (SSW)	133	133
2. Intermediate attestation		
Exam	36	36
Grading test		
Test (Credit)		
Course Project (CP)	36	36
Course Work (CW)		
Workload in hours	**252**	**252**

4. COURSE OUTLINE

Name of the units with the course outline	Full time of classroom activity in hours according to the forms			Full time of extracurricular work in hours according to the forms
	L	LW	PW	SSW
1	2	3	4	5
semester				
Module 1. Petroleum Production System	6	0	0	20
Wellbore Performance Introduction. Single-Phase Liquid Flow. Multiphase Flow in Oil Wells. Single-Phase Gas Flow. Mist Flow in Gas Wells. Choke Performance				

1	2	3	4	5
Introduction. Sonic and Subsonic Flow. Single-Phase Liquid Flow. Single-Phase Gas Flow. Multiphase Flow Well Deliverability Introduction. Nodal Analysis. Deliverability of Multilateral Well. Forecast of Well Production Introduction. Oil Production during Transient Flow Period. Oil Production during Pseudo-Steady Flow Period. Gas Production during Transient Flow Period. Gas Production during Pseudo-Steady Flow Period Production Decline Analysis Introduction. Exponential Decline. Harmonic Decline. Hyperbolic Decline. Model Identification. Determination of Model Parameters. Illustrative Examples				
Module 2. Artificial lift methods	16	8	8	40
Sucker Rod Pumping. Gas Lif.				
Other Artificial Lift Methods Electrical Submersible Pump. Hydraulic Piston Pumping. Progressive Cavity Pumping. Plunger Lift. Hydraulic Jet Pumping				
Module 3. Workover and complications during well operation	4	10	0	31
Well workover. Methods for defining static and dynamic fluid levels in the well. Elimination of sand plugs; Magnification well productivity Well Problem Identification Introduction. Low Productivity. Excessive Gas Production. Excessive Water Production. Liquid Loading of Gas Wells				
Module 4. Collection and treatment of oil and gas and water in the fields	16	0	10	40
Basic System Configuration Wellhead and Manifold. Separation. Oil Treating and Storage. Lease Automatic Custody Transfer (LACT). Pumps. Water Treating. Compressors. Gas Dehydration. Offshore Platform Considerations				
Two-Phase Oil and Gas Separation Functional Sections of a Gas-Liquid Separator. Equipment Description. Selection Considerations. Vessel Internals.				
Potential Operating Problems Foamy Crude. Paraffin. Sand. Liquid Carryover. Gas Blowby. Liquid Slugs				
Three-Phase Oil and Water Separation Equipment Description. Selection Considerations. Vessel Internals. Potential Operating Problems. Separator Design.				
Mechanical Design of Pressure Vessels Design Considerations: Design Temperature. Design Pressure. Maximum Allowable Stress Values. Determining Wall Thickness. Corrosion Allowance. Inspection Procedures. Estimating Vessel Weights.				

1	2	3	4	5
Specification and Design of Pressure Vessels: Pressure Vessel Specifications. Shop Drawings. Nozzles. Vortex Breaker. Manways. Vessel Supports. Ladder and Platform. Pressure Relief Devices. Corrosion Protection.				
Crude Oil Treating and Oil Desalting Systems Equipment Description. Indirect Fired Heaters. Direct Fired Heaters. Waste Heat Recovery. Heater Sizing. Vertical Heater-Treaters. Coalescing Media. Horizontal Heater-Treaters. Electrostatic Heater-Treaters. Oil Dehydrators. Heater-Treater Sizing. Emulsion Treating Theory. Emulsion Treating Methods.				
Crude Stabilization Basic Principles. Process Schemes. Equipment Description. Stabilizer Design. Stabilizer As a Gas-Processing Plant.				
Produced Water Treating Systems Disposal Standards. Characteristics of Produced Water. Sand and Other Suspended Solids. System Description: Gravity Separation. Coalescence. Dispersion. Flotation. Filtration. Equipment Description and Sizing. Skimmer Sizing Equations. Coalescers. Cross-Flow Devices.				
Water Injection Systems Solids Removal Theory. Filter Types. Removal Ratings. Choosing the Proper Filter. Measuring Water Compatibility. Solids Removal Equipment Description.				
Conclusion.	1	0	0	
Total with regard to semester	45	18	18	33
Total with regard to the course	45	18	18	33

Topics of exemplary practical work

Sl.№	Topic of practical (seminar) work
1	Determination of bottomhole pressure in wells
2	Calculation of pressures during well completion by fluid replacement
3	Calculation of the sucker rod pump rate
4	Determination of parameters of the ESP
5	Analysis of the technological regime of production wells
6	Hydraulic calculation of oil pipelines
7	Hydraulic calculation of field gas pipelines
8	Technological calculation of field separators
9	Selection of pumps for oilfield systems

Topics of exemplary laboratory practice

Sl.№	Topic of laboratory work
1	Determination of the type of gas-liquid flow structure
2	Investigation of the operation of a gas-liquid lift with constant immersion under dynamic level
3	Study of the influence of relative immersion on the operation of a gas-liquid lift
4	Study of the influence of gas on the operation of a sucker rod pump

Subject of sample course projects / works

Sl.№	Topic
1	Analysis and improvement of well operation efficiency in the field
2	Analysis and improvement of the operational efficiency of the gathering system in the field
3	Analysis and improvement of the operational efficiency of the oil treatment system in the field
4	Analysis and improvement of the operational efficiency of the gas treatment system at the field
5	Analysis and improvement of the operational efficiency of the waste water treatment system at the field

5. ORGANIZATIONAL AND PEDAGOGICAL CONDITIONS

5.1. EDUCATIONAL TECHNOLOGIES USED FOR COMPETENCES FORMATION

Holding lectures in the discipline is based on the active method of training in the process of which students are not passive but active participants of the lesson answering questions of the teacher. Teacher's questions are aimed at activating the process of learning material as well as at the development of logical thinking. The questions stimulating associative thinking and connecting new material with the previous one are identified by the teacher in advance.

Practical lessons are held by realization of the method based on active training: problem areas are determined, groups are formed. The following aims are pursued in the process of practical education: use of definite disciplines knowledge and creative methods in solving problems and decision-making; students' skill-building of teamwork, interpersonal communication and development of leadership skills; consolidation of the basic theoretical knowledge.

Laboratory classes are based on an interactive learning method in which students communicate not only with the teacher but also with each other. At the same time, students ' activity in the learning process dominates. The teacher's place in interactive classes is reduced to orienting students ' activities to achievement of the goals of studies.

Interactive lectures, group discussions, role-playing games, training sessions, and analysis of situations and simulation models are used in academic studies

5.2. STUDENTS' MANUAL FOR THE COURSE STUDY

Learning the course students are recommended to fulfill the following positions:

1. Learning of the discipline should be done systematically.

2. After learning one of the course unit with the help of the text-book or lecture notes it is recommended to reproduce in memory the basic terms, definitions, notions of the unit.

3. Special attention should be paid to the reports on practical studies, laboratory works and individual complex tasks for self-work.

4. The topic of questions studied individually is given by the teacher at the lectures. Also the teacher refers to the literary resources (first of all, to the newly published in periodicals) in order the students understand the problems touched on the lectures in detail.

6. LIST OF TEACHING MATERIALS AND INFORMATION SUPPLY FOR STUDENTS' SELF WORK IN THE DISCIPLINE

6.1. PAPER-BASED COURSEWARE

Sl.№	Bibliographic entry (author, title, mode of publication, place, publishing house, year of publication, number of pages)	Number of copies in the library
	1. Basic literature	
1	Horn G. M. Coal, Oil, and Natural Gas / G. M. Horn. – New York: Chelsea Clubhouse, 2010.	1
2	Oil and Gas : Student's Book : in 2 vol. – Oxford: Oxford Univ. Press, 2011.	1
	2. Additional literature	
	2.1. Educational and scientific literature	
1	Zhumagulov B.T. The Fluid Dynamics of Oil Production / B.T. Zhumagulov, V.N. Monakhov. – Milan: Without publ., 2003.	1
2	Peyret R. Computational Methods for Fluid Flow / R. Peyret, T. D. Taylor. – New York: Springer-Verlag, 1983.	5
	2.2. Standardized and Technical literature	
1	Vol. 1 / L. Lansford, V. D`Arcy. – Oxford: , Oxford Univ. Press, 2011. – (Oil and Gas : Student's Book : in 2 vol.; Vol. 1).	129
2	Vol. 2 / J. Naunton, A. Pohl. – Oxford: , Oxford Univ. Press, 2011. – (Oil and Gas : Student's Book : in 2 vol.; Vol. 2).	70
	3. Students' manual in mastering discipline	
1	Mechanics of Fluids. – Oxford, Warszawa: , Pergamon Press, Widawnictwa Haukowo-Techniczne, 1967. – (Vocabulary of Mechanics in five languages : English. German. French. Polish. Russian; Vol. 2, Group 15.).	1
	4. Teaching and learning materials for students' self work	
1	Marchioro C. Vortex Methods in Two-Dimensional Fluid Dynamics / C. Marchioro, M. Pulvirenti. – Berlin: Springer-Verlag, 1984.	1

6.2. ELECTRONIC COURSEWARE

Kind of literature	Name of training tool	Reference to information resource	Accessibility of EBN (Internet/ local net; authorized free assess)
Additional literature	Zhumagulov B.T. The Fluid Dynamics of Oil Production / B.T. Zhumagulov, V.N. Monakhov. – Milan: Without publ., 2003.	http://elib.pstu.ru/vufind/Record/RUPSTUbooks110755	the local network
Additional literature	Vol. 2 / J. Naunton, A. Pohl. – Oxford: , Oxford Univ. Press, 2011. – (Oil and Gas : Student's Book : in 2 vol.; Vol. 2).	http://elib.pstu.ru/vufind/Record/RUPSTUbooks156679	the local network
Additional literature	Horn G. M. Coal, Oil, and Natural Gas / G. M. Horn. – New York: Chelsea Clubhouse, 2010.	http://elib.pstu.ru/vufind/Record/RUPSTUbooks157259	the local network

6.3. LICENSE AND FREE DISTRIBUTED SOFTWARE USED IN THE COURSE EDUCATIONAL PROCESS

Type of Software	Software branding
OS	Windows 10 (Azure Dev Tools for Teaching)
Office Applications	Adobe Acrobat Reader DC
Image processing software	Corel CorelDRAW Suite X4
General purpose application software	Mathematica Professional Version (license L3263-7820*)
General purpose application software	Microsoft Office Visio Professional 2016 (Azure Dev Tools for Teaching)
General purpose application software	WinRAR (license №879261.1493674)
Management systems for projects, research, development, design, modeling and implementation	Autodesk AutoCAD 2019 Education Multi-seat Stand-alone

6.4. MODERN PROFESSIONAL DATABASES AND INQUIRY SYSTEMS USED IN THE COURSE EDUCATIONAL PROCESS

Branding	Reference to information resource
Scopus database	https://www.scopus.com/
Web of Science Database	https://www.webofscience.com/
Scientific electronic library database (eLIBRARY.RU)	https://elibrary.ru/
Scientific Library of the Perm National Research Polytechnic University	https://lib.pstu/
Lan Electronic Library System	https://e.lanbook.com/
Electronic library system IPRbooks	https://www.iprbookshop.ru/
Information resources of the Network ConsultantPlus	https://www.consultant.ru/
Company database EBSCO	https://www.ebsco.com/

7. LOGISTICS OF THE COURSE EDUCATIONAL PROCESS

Type of classes	Name of the necessary basic equipment	Number of units
Course Work (CW)	Desks, teacher's table, chairs	30
laboratory work (LW)	Complete computers (system unit, monitor, keyboard, mouse) with Internet access – 15 pieces. Desks, teacher's table, chairs	15
laboratory work (LW)	Multimedia complex consisting of multimedia – ceiling mount ViewSonic PG705HD projector, SmartBoard 690 interactive whiteboard, acoustic system.	1
lectures (L)	Multimedia complex consisting of multimedia – ceiling mount ViewSonic PG705HD projector, SmartBoard 690 interactive whiteboard, acoustic system. Desks, teacher's table, chairs	1
Practice	Desks, teacher's table, chairs	30

8. FUND OF THE COURSE EVALUATING TOOLS

Described in a separate document

Ministry of Science and Higher Education of the Russian Federation

Federal State Budgetary Educational Institution of Higher Education

Perm National Research Polytechnic University

FUND OF ESTIMATING TOOLS

For students' midterm assessment in the discipline
Well production and surface facilities engineering
Supplement to the Academic Course Working Program

Training program	21.03.01 Oil and Gas Engineering
Direction (specialization) of educational program	Oil and Gas Engineering
Graduate qualification	Bachelor's degree
Graduate academic chair	Oil and Gas Technology
Form of study	Full-time studies

Year (-s): 2 **Semester (-s)**: 7

Workload
in credits 9 CU
in hours 252 h

The form of midterm assessment:

Exam	7 semester
Course Project	7 semester

Perm 2021

Fund of estimating tools for midterm assessment of students' learning the subject **"Well production and surface facilities engineering"** is the part (supplement) to the academic course working program. Fund of estimating tools for midterm assessment of students' learning the discipline has been developed in accordance with the general part of the fund of estimating tools for midterm assessment of the basic educational program which determines the system of the midterm assessment results and criteria of putting marks. Fund of estimating tools for midterm assessment of students' learning the subject determines the forms and procedures of monitoring results and midterm assessment of the subject leaning by the students.

1. LIST OF CONTROLLED RESULTS OF STUDYING DISCIPLINE, OBJECTS OF ASSESSMENT AND FORMS OF CONTROL

According to the Academic Course Working Program mastering course content is planned during one semester (the fourth semester of curriculum) and is divided into three educational modules. Classroom activities, lectures and laboratory work as well as students' self-work are provided for every module. In the frames of mastering course content such competences as *to know, to be able, to master* pointed out in the ACWP are formed. These competences act as the controlled results of learning the discipline **"Well production and surface facilities engineering"** (Table 1.1).

Monitoring of the acquired knowledge, abilities and skills is made in the frames of continuous assessment, progress check and formative assessment in the process of studying theoretical material, reports on laboratory works and during examination. Types of control is given in Table 1.1

Table 1.1 – List of controlled results of learning the discipline

Controlled results of learning the discipline (KAS)	Type of control					
	Continuous assessment		Progress check		Formative assessment	
	D	AC	LWR/ PWR	T/CW	Exam	Course project
1	2	3	4	5	6	7
Acquired knowledge						
K.1.structure and methods of reporting	+				+	
K.2. technical documentation for the operation of technical devices that are part of the well, wellhead equipment	+				+	
K.3. regulatory and limiting parameters of equipment for the extraction of hydrocarbons	+				+	
K.4.advanced repair technologies, progressive methods and techniques of labor	+				+	

1	2	3	4	5	6	7
K.5. purpose, device and principle of operation of equipment for the extraction of hydrocarbons	+				+	
K.6. technological processes for the extraction of hydrocarbons	+				+	
K.7. advanced technologies in the operation of well equipment and oil field systems	+				+	
K.8. advanced energy-saving technologies in the operation of equipment for the extraction of hydrocarbons.	+				+	
K.9. the procedure for calculating the performance of a production well using software products	+				+	
K.10. advanced energy-saving technologies in the operation of equipment for the extraction of hydrocarbons	+				+	
K.11. requirements of technical documentation in the field of hydrocarbon production	+				+	
K.12. industry standards, technical regulations, manuals (instructions) that establish requirements for the operation of equipment for the extraction of hydrocarbons	+				+	
K.13. requirements of regulatory documents in the field of accidents and incidents accounting	+				+	
K.14. requirements for the preparation of project documentation	+				+	
Acquired abilities						
A.1.develop an action plan for the study of wells and oilfield equipment	+		+	+		
A.2. draw up action plans to fulfill planned targets for the production of hydrocarbon raw materials	+		+	+		
A.3. to prepare draft long-term, annual and monthly plans for the production of hydrocarbon raw materials, for the use of hydrocarbon raw materials for own needs and the estimated losses of hydrocarbon raw materials	+		+	+		
A.4. to coordinate rationalization activities	+		+	+		
A.5. analyze the actual and predicted parameters of the reservoir-well system, submersible pumping equipment of the production gathering system	+		+	+		
A.6. formulate proposals for the introduction of advanced technologies in the operation of well equipment and oilfield systems	+		+	+		
A.7. Analyze the technical parameters of equipment for the extraction of hydrocarbons	+		+	+		
A.8. Analyze the performance of wells and oilfield systems	+		+	+		
A.9. Analyze the volumes of hydrocarbon production	+		+	+		
A.10. Analyze the effectiveness of the measures taken to fulfill the tasks for the extraction of hydrocarbons	+		+	+		

1	2	3	4	5	6	7
A.11. Analyze the reasons for deviations of the operating parameters of hydrocarbon production facilities from the norms of technological parameters	+		+	+		
A.12. prepare proposals for the modernization and reconstruction of operating equipment for the extraction of hydrocarbons, develop test programs	+		+	+		
A.13. develop plans for the introduction of new equipment, advanced technologies, research and development projects aimed at improving the reliability of equipment for the extraction of hydrocarbons	+		+	+		
A.14. analyze operational and technical documentation for the operation of equipment in the production of hydrocarbon raw materials	+		+	+		
A.15. develop production and technical documentation for the implementation of planned targets for the production of hydrocarbon raw materials by divisions	+		+	+		
Mastered skills						
S.1. skills in accounting for the availability and condition of equipment for the production, collection and preparation of hydrocarbons						+
S.2. skills in checking the operation of equipment for the production, collection and preparation of hydrocarbons						+
S.3. skills to control the implementation of maintenance schedules for wellhead equipment, piping, oil and gas field pipelines, prefabricated pipelines, gas pipelines-loops, inhibitor pipelines and valves						+
S.4. skills of presenting measures for the prevention and elimination of accidents and incidents in the production of hydrocarbons						+
S.5. skills in presenting proposals for improving the efficiency of equipment for wells and oilfield systems						+
S.6. skills in the development of technical documentation for the operation of technical devices that are part of the well, wellhead equipment of the well and oil field systems						+
B.7. the skills of reading technological schemes, drawings and technical documentation						+
S.8. skills of using specialized software products						+
S.9. skills in predicting optimal well production rates						+
S.10. skills in determining technological losses of hydrocarbon raw materials during production in accordance with the adopted scheme and technology of field development						+
S.11. skills in developing measures to optimize hydrocarbon production						+

1	2	3	4	5	6	7
S.12. skills in predicting the occurrence of complications in the production, collection and treatment of oil, gas and water						+
S.13 skills in drawing up plans for the production of hydrocarbons, the use of hydrocarbons for own needs						+

D – topic discussion; AC –colloquium (discussion of theoretical material, academic conference); CT – case-task (individual task); LWR – report on laboratory work; PWR – report on practical work; T/CW – progress check (control work); TQ – theoretical question; PT – practical task; CT – complex task of grading test.

Final assessment of the learned discipline results is the midterm assessment which is made in the form of test taking into consideration the results of the running and progress check.

2. TYPES OF CONTROL, STANDARD CONTROL TASKS AND SCALES OF LEARNING RESULTS ASSESSMENT

Continuous assessment of the academic performance is aimed at maximum effectiveness of the educational process, at monitoring students' specified competencies formation process, at increase of learning motivation and provides the assessment of mastering the discipline. In accordance with the regulations concerning the continuous assessment of the academic performance and midterm assessment of students taught by the educational programs of Higher education

– programs of the Bachelor's Course, Specialists' and Master's Course the next types of students' academic performance continuous assessment and its periodicity is stipulated in PNRPU:

– acceptance test, check of the student's original preparedness and his correspondence with the demands for the given discipline learning;

– continuous assessment of mastering the material (the level of mastering the component "to know" defined by the competence) at every group studies and monitoring of lectures attendance;

– interim and progress check of students' mastering the components "to know" and "to be able" of the defined competences by computer-based or written testing, control discussions, control works (individual home tasks), reports on laboratory works, reviews, essays, etc.

Discipline progress check is conducted on the next week after learning the discipline module, while the interim control is made at every monitoring during the discipline module study;

– interim assessment, summarizing of the current students' performance at least once a semester in all disciplines for every training program (specialty), course, group;

– retained knowledge control.

2.1. CONTINUOUS ASSESSMENT OF EDUCATION

Continuous assessment of learning is made in the form of discussion or selective recitation on every topic. According to the four-point system the results of assessment are put into the teachers' note-book and are considered in the form of integral mark in the process of the midterm assessment.

2.2. PROGRESS CHECK

Midterm control for a comprehensive assessment of the acquired knowledge, mastered skills and acquired possessions of the disciplinary parts of the competencies (Table 1.1) is carried out according to the schedule of the educational process, in the form of protection of reports on practical exercises and laboratory work, course project, midterm tests (after study of each module of the academic discipline).

2.2.1. Presentation of laboratory work

It is planned 4 laboratory works all in all. Standard topics of laboratory work are given in ACWP.

Presentation of laboratory work is made by the student individually or by the group of students. Standard scale and criteria of assessment are given in the general part of FET of the educational program.

2.2.2. Midterm control work

According to ACWP 3 midterm control works (CW) is planned to be realized after learning the educational modules of the discipline by the students.

The first CW is realized with respect to the module 2 «**Artificial lift methods**», the second CW – with respect to the module 3 «**Workover and complications during well operation**», the three CW – with respect to the module 3 «**Collection and treatment of oil and gas and water in the fields**».

Standard tasks of the first CW:

• Artificial Lift Methods (Sucker Rod Pumping. Gas Lif. Electrical Submersible Pump. Hydraulic Piston Pumping. Progressive Cavity Pumping. Plunger Lift. Hydraulic Jet Pumping)

Standard tasks of the second CW:

• Well workover. Methods for defining static and dynamic fluid levels in the well. Elimination of sand plugs; Magnification well productivity

Standard tasks of the three CW:

Basic System Configuration (Wellhead and Manifold. Separation. Oil Treating and Storage. Lease Automatic Custody Transfer (LACT). Pumps. Water Treating. Compressors. Gas Dehydration. Offshore Platform Considerations)

Standard scale and criteria of the results of the midterm control work assessment are given in the general part of FET of the educational program.

2.3. FULFILLMENT OF THE COMPLEX INDIVIDUAL SELF-WORK TASK

Individual complex tasks for the students are used for assessment of their skills and abilities acquired in the process of learning the discipline in which the course project or course paper is not stipulated.

Standard scale and criteria of assessment of the individual complex task presentation are given in the general part of FET of the educational program.

2.4. MIDTERM ASSESSMENT (FINAL CONTROL)

Admission for midterm assessment is made according to the results of continuous assessment and progress check. Preconditions for admittance are successful presentation of all laboratory and practice works and positive integral estimation with respect to the results of continuous assessment and progress check.

2.4.1. Midterm assessment procedure without additional evaluation testing

Midterm assessment is made in the form of an exam. Credit on the discipline is based on the results of the previously fulfilled by the student individual tasks on the given discipline. It is carried out in the form of a discipline exam orally using cards. The card contains 2 theoretical questions to test the acquired knowledge to test the acquired knowledge of all declared disciplinary competencies.

The exam card is formed in such a way that it includes questions that control the level of formation of all declared disciplinary competencies. The ticket form is presented in the general part of the undergraduate program.

Criteria of putting the final mark for the components of competences in the process of midterm assessment made in the form of test are given in the general part of FET of the educational program.

2.4.2. Midterm assessment procedure followed by evaluation testing

In definite cases (for example, in case of re-attestation of the discipline) midterm assessment in the form of the test on this discipline can be made as the ticket-based evaluation test. Every ticket includes theoretical questions(TQ) aimed at control of the acquired knowledge, practical tasks (PT) aimed at mastered abilities, and complex tasks (CT) aimed at control of the acquired skills of all declared competences.

The ticket is formed so that the included questions and practical tasks could estimate the level of maturity of **all** declared competences.

2.4.2.1. Standard questions and tasks the discipline testing

Standard questions for the acquired knowledge control:

- Wellbore Performance
- Choke Performance
- Well Deliverability
- Forecast of Well Production
- Production Decline Analysis
- Artificial lift methods
- Well workover
- Collection and treatment of oil and gas and water in the fields
- Water Injection Systems
- Crude Oil Treating and Oil Desalting Systems
- Mechanical Design of Pressure Vessels
- Well flowing. Artesian gushing. Gas-liquid lift. Bottom-hole pressure during artesian gushing and in a well with a gas-liquid lift (calculation scheme). Influence of wellhead pressure on bottomhole pressure during well flowing.
- Distribution of pressure in the gas-liquid lift. Method for constructing pressure distribution curves in the production casing and in the tubing string.
- Density of the gas-liquid mixture in the well. Density change during liquid rise.
- Structures of gas-liquid flows: bubble (emulsion), bead (cork), pivot. Forms of movement of gas-liquid mixtures.
- Temperature distribution in the well during its operation. Geothermal gradient.
- Dynamic and static levels during the operation of a mechanized well. Measurement of levels. Echo sounders.
- The composition and purpose of the elements of the sucker rod pump. Operating principle.
- Dynamometry of wells. Forms and decoding of dynamogram.
- Periodic operation of production wells.
- Determination of the pump suspension depth in the well.
- The choice of installing a sucker rod pump for a well.
- Selecting the installation of an electric centrifugal pump for a well. Installation composition.
- Determination of the head developed by the ESP during operation in the well.
- Influence of the viscosity of liquid and free gas on the head and supply of the ESP.
- Influence of gas on the operation of sucker rod pumps and ESP. Reducing the harmful effects of gas.
- Efficiency of the installation of an electric centrifugal pump.

- Well waxing.
- Salt deposits during well operation.
- Gas separation coefficient at the inlet of the borehole pump.
- Jet pumping. Composition, work.
- hydraulic piston pumps for oil production. Composition, work.
- Gas-lift operation of production wells. Installation composition, work.
- Starting pressure during gas-lift operation.
- Pressure at the wellhead and at the bottom of the injection well.
- Direct and reverse fluid substitution schemes in wells during their development. Bottom hole pressure.
- Methods for reducing the fluid level in wells during their development. Induction of fluid flow into the well using a swab and a thief. Reducing the level with a compressor.
- Well killing. Technological process. Applied equipment.
- Density of water-oil and gas-liquid mixture.
- Requirements for the quality of commercial oil.
- Requirements for the quality of gas pumped into the main gas pipeline. Dangerous properties of gas.
- Schemes and composition of the system for gathering and preparation of oil production wells.
- Initial data for designing a system for gathering and preparing well products.
- Measurement of flow rates, water cut and gas factors of producing wells.
- Separation of oil (separation of associated gas). Separation types.
- Hydraulic calculation of the oil pipeline. Targets and goals.
- Hydraulic calculation of complex oil pipelines.
- Increasing the throughput of oil pipelines.
- Principles of calculating gravity separators for gas and liquid throughput.
- Waxing of oil gathering systems. Dewaxing of oil pipelines.
- Oil preparation in the field. Targets and goals.
- Characteristics of oil emulsions.
- Destruction of oil emulsions (demulsification).
- Thermochemical dehydration and desalination of oil in the fields.
- Collection, preparation and disposal of wastewater in the fields.

2.4.2.2. Scales of test assessment of educational achievements

The assessment of the learning outcomes in the discipline in the form of the level of formation of the components to know the declared disciplinary competencies is carried out on a 4-point scale of assessment by sampling during the exam.

Standard scale and criteria of estimating educational achievements in the process of testing for the components *to know, to be able, to master* are given in the general part of FET of educational program.

2.4.2.3. Scales for assessing learning outcomes for the defense of course projects

Assessment of learning outcomes in a discipline in the form of the level of formation of components to know, be able to, own the declared disciplinary competencies is carried out on a 4-point scale of assessment by sampling during the exam.

Standard scale and criteria of estimating educational achievements in the process of testing for the components *to know, to be able, to master* are given in the general part of FET of educational program.

3. ASSESSMENT CRITERIA FOR COMPONENTS AND COMPETENCES LEVEL OF MATURITY

3.1. ASSESSMENT OF COMPETENCES COMPONENTS LEVEL OF MATURITY

While estimating the level of competences maturity by selective control in the process of testing it is considered that *the mark obtained for the components of the examined competence is combined with the corresponding component of all competences formed in the frames of the given academic course.*

General assessment of maturity level of all competences is made by aggregation of marks obtained by the student for each component of the formed competences taking into account the results of continuous assessment and progress check in the form of integral mark according to the four-point scale. All control results are put into the assessment sheet by the teacher according to the results of midterm attestation.

The form of the assessment sheet and requirements for its completion are given in the general part of FET of the educational program.

While making the final assessment of the midterm attestation in the form of test standard criteria given in the general part of FET of the educational program are used.