

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

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20 21

ACADEMIC COURSE WORKING PROGRAM

Academic course: Study and Research work
 (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): 288 (8)
 (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)

1. GENERAL PROVISIONS

1.1. GOALS AND OBJECTIVES OF THE COURSE

The goal of the course is to form a system of knowledge and develop skills in the field of Study and Research work.

Objectives of the course:

1. to prepare students for self-development, critical analysis and application of theoretical and practical knowledge in the field of Oil and Gas Engineering.
2. to develop skills of qualified analysis, obtaining and processing results of scientific research carried out by other specialists, using new information technologies, modern techniques, advanced domestic and foreign experience.
3. to teach students to produce new ideas, show creativity, adapt to new situations, use and implement accumulated experience, estimate self-capabilities, change scientific profile of professional activities.
4. to teach students preparing and editing scientific publications

1.2. STUDIED OBJECTS OF THE COURSE

1. Patent research.
2. Scientific abstracts.
3. Theoretical and experimental research.
4. Inventions.
5. Utility models.
6. Industrial design.
7. Engineering and technology for the extraction, collection and treatment of oil and gas fossils.

1.3. STARTING CONDITIONS

Unstipulated

2. PLANNED RESULTS OF THE COURSE TRAINING

Competence	Indicator's Index	Planned Results of the Course Training (to know, be able to, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
1	2	3	4	5
GPC-3	IA-1 _{gpc-3}	To know: – methods and means of project management in oil and gas field; – the basics of production	Knows the basic foundation of logistics with reference to oil-and-gas enterprise when general production steps are made	Research report

1	2	3	4	5
		management and staff administration; – achievements of science and technology in the field; – advanced domestic and foreign experience in the field of hydrocarbon production and raw materials; – the process of material and technical support during well workover.	in conditions of uncertainty.	
	IA-2 _{gpc-3} .	To be able t: – effectively use resources available for hydrocarbon production; – control well workover and manage logistics.	Is able to practically apply the elements of industrial management; realize the possibilities of entrepreneurship at overseen entity and its legislative control; find the possibility of combining basic duties with the elements of entrepreneurship.	Grading test
	IA-3 _{gpc-3} .	To master: – previously obtained skills; – leadership skills; – the skills of production tasks assignment; – the skills of preparing technical reports.	Masters the skills of personnel management in small production unit; skills of principle appraisal of the applied entrepreneurship activity at the enterprise.	Research report
GPC-5	IA-1 _{gpc-5} .	To know: – software products in the field of oil and gas production	Knows content and properties of oil and gas, general provisions of metrology, qualimetry, standardization and certification of oil production.	Selfwork
	IA-2 _{gpc-5} .	To be able to: – use software to prepare and render reports; – use obtained knowledge about mining technologies of hydrocarbons; – evaluate the efficiency of work hours for selected criteria using applied hardware; – estimate the level of necessity in modern information technologies to perform production activities.	Is able to use computer with aim to make simple engineering calculation; use appropriately software packages; use general technologies of exploration and prospect for oil as well as organization of oil production in Russia and abroad, standards and specification, sources of information, mass media and multimedia technologies; acquire knowledge by the application of modern educational and information	Research report

1	2	3	4	5
			technologies; orient in data flows selecting principal and necessary information; consciously assimilate information, independently find, derive, systematize, analyze and select necessary information aimed at problems solution, organize, transform, store and pass it; critically reconsider cumulative information, form personal opinion, convert information into knowledge, apply information in problems solution using different ways of text processing.	
GPC-5	IA-3 _{gpc-5} .	To master the skills in implementation of research projects.	Masters the skills of risk assessment and management of quality performance of manufacturing operations; methods of collection and processing of obtained information using modern information technologies and applied hardware and software, methods of information security, storage and submission.	Test

3. FULL TIME AND FORMS OF ACADEMIC WORK

Form of academic work	Hours in all	Distribution in hours according to semesters			
		Number of semester			
		1	2	3	4
1. Holding classes (including results monitoring) in the form:					
1.1. Contact classwork, including:					
– lectures (L)					
– laboratory work (LW)					
– practice, seminars and/or other seminar-type work (PW)	144	36	36	36	36
– control of self-work (CSW)	8	2	2	2	2
– test					
1.2. Students' self-work (SSW)	144	36	36	36	36
2. Intermediate attestation					
Exam					
Grading test	6				6
Test (Credit)	27	9	9	9	
Course Project (CP)					
Course Work (CW)					
Workload in hours	288	72	72	72	72

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
Semester 1				
Introduction to Oil and Gas Engineering	0	0	36	34
Fundamentals of Oil and Gas engineering. Current scientific industrial issues in the field of Oil and Gas. Students Research work Guided tours to laboratories of Oil and Gas Engineering department Structure and main stages of research activity How to select a research topic?				
TOTAL for the 1st semester	0	0	36	34
Semester 2				
Basics of research activity	0	0	36	34
Relevance of the research topic Developing a work plan for research work of investigated problem The purpose of the research work and its objectives Object and Subject of research Organization and methods of research activity: summarizing empirical data and its interpretation in descriptive and illustrative way Preparing a presentation and a report on a selected topic.				
TOTAL for the 2st semester	0	0	36	34
Semester 3				
Preparing scientific articles and works	0	0	36	34
Working with references including patents. Searching for analogues in electronic databases through the library Choosing a topic of laboratory research in educational research work Choosing a supervisor Making conclusion on the received results Preparing scientific articles and works for participation in conferences.				
TOTAL for the 3st semester	0	0	36	34
Semester 4				
Public speech	0	0	36	34
The rules of rendering a report and making presentation using modern information technologies Scientific reports presentation at scientific conferences and seminars, writing scientific articles, term papers and theses, master's thesis, their structure.				
TOTAL for the 4st semester	0	0	36	34
Total with regard to the course	288		144	136

Topics of exemplary practical work

Sl.№	Topic of practical (seminar) work
1	General information about Oil and Gas production
2	Issues in the field of Oil and Gas production
3	Promising scientific directions in the field of Oil and Gas engineering
4	Content of scientific work
5	Research structure
6	Hirsch index
7	How to find scientists related to the research topic?
8	Scientific grant systems in various countries
9	Commercialization of scientific developments
10	How to start working on your graduation thesis?
11	Scientific work plan
12	Experimental work plan
13	Processing of experimental results
14	Statistical methods of information processing
15	Electronic databases and libraries
16	Search for articles in scientific journals. Scopus. Web of Science
17	Research methods and techniques
18	Results analysis and processing
19	Presentations of research work using modern information technologies
20	Presentations
21	Reporting on scientific work

5. ORGANIZATIONAL AND PEDAGOGICAL CONDITIONS

5.1. EDUCATIONAL TECHNOLOGIES USED FOR COMPETENCES FORMATION

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.

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.No	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
3	Sokolova N.V. How to Write a Research Paper: study guide / N.V. Sokolova. – Perm: PNRPU Publishing House, 2017	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, Wydawnictwa Naukowo-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 access)
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
Additional literature	Sokolova N.V. How to Write a Research Paper: study guide / N.V. Sokolova. – Perm: PNRPU Publishing House, 2017	http://elib.pstu.ru/vufind/Record/RUPNRPUelib3955	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 DATA BASES 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

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FUND OF ESTIMATING TOOLS

For students' midterm assessment in the discipline
“Study and Research work”
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): 1, 2	Semester (-s): 1, 2, 3, 4

Workload:

in credits: 8 CU

in hours: 288 h

The form of midterm assessment:

Test: 1, 2, 3 semesters

Grading test: 4 semester

Fund of estimating tools for midterm assessment of students' learning the subject "Study and research work" 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 "Study and research work" (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. the basics of logistics in Oil-and-Gas enterprise when general production steps are made in conditions of uncertainty			PWR	T/CW		
K.2. oil and gas composition, general provisions of metrology, qualimetry, standardization and certification of oil production			PWR	T/CW		
Acquired abilities						
A.1. Can practically apply industrial management skills; if possible, realize entrepreneurship activity at overseen entity and its legislative control; to combine basic duties with the elements of entrepreneurship.			PWR			

1	2	3	4	5	6	7
A.2. Can use computer and software packages to make simple engineering calculation; apply and use general technologies of oil and gas exploration to organize oil production in Russia and abroad; find and use standards and specification, sources of information, mass media and multimedia technologies; acquire knowledge with the help of modern educational and information technologies; orient in data flows selecting principal and necessary information; independently find, derive, systematize, analyze and select necessary information aimed at problems solution; organize, transform, store and send this information; critically consider acquired information and develop personal opinion, convert information into knowledge, apply obtained information in problems solution using different ways of text processing			PWR			
Mastered skills						
S.1. Masters skills of personnel management in small production unit; principle appraisal of the applied entrepreneurship activity at the enterprise			CT			
S.2. Masters methods of risk assessment and management of quality performance in manufacturing operations; collection and processing of obtained information using modern information technologies, applied hardware and software, methods of information security, storage and submission			CT			

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 practice work

It is planned 31 practice work all in all. Standard topics of practice work are given in ACWP.

Presentation of practice 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 1 midterm control works (CW) is planned to be realized after learning the educational modules of the discipline by the students.

Standard tasks of the CW:

1. The intake valve of the sucker rod pumping unit is created:
 - 1) at the bottom of the cylinder
 - 2) at the top of the cylinder
 - 3) at the bottom of the plunger
 - 4) at the top of the plunger
 - 5) at the bottom of the tubing
2. The oil treatment unit is necessary for:
 - 1) Preparations to the required quality group
 - 2) Decrease in associated gas production at the enterprise
 - 3) Increasing the degree of utilization of associated gas
3. Hydraulic fraction is carried out for:
 - 1) Increase in oil production at the well.
 - 2) Decrease in well flow rate
 - 3) Reducing the profitability of oil production
4. When acidizing carbonate rocks are used.
 - 1) Hydrofluoric acid
 - 2) Hydrochloric acid
 - 3) Sulfuric acid
 - 4) Acetic acid
5. The main component of oil is:
 - 1) Nitrogen
 - 2) Hydrogen sulfide
 - 3) Carbon
6. The destruction of rocks during drilling occurs with the help
 - 1) Tubing
 - 2) Chisels
7. A production well designed for
 - 1) injection of gas or water into the reservoir
 - 2) lifting well production to the day surface
 - 3) for pumping out the well product from the wellhead to the collection point
8. In a producing well, the relationship between pressure is as follows:
 - 1) bottomhole pressure is equal to wellhead pressure
 - 2) bottomhole pressure is less than wellhead pressure
 - 3) bottomhole pressure is greater than wellhead pressure
 - 4) reservoir pressure is greater than bottomhole pressure

- 5) reservoir pressure is less than bottomhole pressure
- 6) reservoir pressure is equal to bottomhole pressure
- 9. The ratio of produced water and produced fluid is:
 - 1. Well flow rate
 - 2. Water cut
 - 3. Service factor
- 10. An injection well is required for
 - 1) injection of oil from the reservoir
 - 2) water injection into the reservoir
 - 3) the rise of water from the reservoir
 - 4) lifting oil from the reservoir

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 practice works and positive integral estimation with respect to the results of continuous assessment and progress check.

2.4.1. 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 card-based evaluation test. Every exam card 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 exam card is formed so that the included questions and practical tasks could estimate the level of maturity of **all** declared competences.

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.