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**Federal State Autonomous Educational Institution of Higher Education
Peoples' Friendship University of Russia named after Patrice Lumumba
RUDN University
Academy of Engineering**

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

**Methods of oil production intensification / Методы интенсификации добычи
нефти**

course title

Recommended by the Didactic Council for the Education Field of:

21.04.01 Oil and gas engineering

field of studies / speciality code and title

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

Oil and gas engineering / Технологии добычи и транспортировки нефти и газа

higher education programme profile/specialisation title

1. COURSE GOALS

The goal of the course "Methods of oil production intensification / Методы интенсификации добычи нефти" is the acquisition of knowledge, skills and experience in the field of modern methods of reservoir stimulation to increase oil well production rates, technologies for implementing these methods, as well as methods that affect the productivity or injectivity of wells, which characterize the stages of formation of competencies and ensure the achievement of planned results development of the educational program.

The study of the course "Methods of oil production intensification / Методы интенсификации добычи нефти" provides for the acquisition of practical skills in solving certain design problems for choosing a method for intensifying well operation, using previously acquired knowledge. It is planned to study the field experience of using various technologies and methods of production stimulation, as well as mastering the methodology for field analysis of the effectiveness of the implementation of various geological and technological measures.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course "Methods of oil production intensification / Методы интенсификации добычи нефти" is designed for students to acquire following competences (competences in part):

Table 2.1. List of competences that students acquire during the course

Competence code	Competence descriptor	Competence formation indicators (within this course)
SPC-4	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	<p>1 Knows the principles, physical foundations, technical support of technical control and diagnostic methods, modern developments in the field of strength of materials, fracture mechanics, materials technology and materials science; design features, manufacturing technology, operation and repair of the control object, types and types of defects, probable zones of their formation, taking into account the loads acting on the object and other factors, principles, physical foundations, technical support for the types and methods of technical control and diagnostics; principles of construction, functional diagrams and rules for operating equipment for a given method of control, rules for selecting and checking the quality of used consumable flaw detection materials; control systems used to check objects (products) of a certain type; metrological support; standards, calculation methods and other applicable regulatory documents and rules for assessing the technical condition; harmful environmental factors of this control method and ways to prevent their impact on the environment and humans; principles of planning and organization of work of technical control and diagnostic units, current state and prospects for the development of technical control and diagnostic methods; rules for electrical safety and fire safety, rules for the construction and safe operation of facilities</p> <p>SPC-4.2 Can determine the methods, equipment, technologies and techniques to be used for specific types of objects; perform control operations, evaluate and identify the results of control and testing, issue conclusions on the results of technical control and diagnostics; organize, conduct and manage calculations and experimental work to assess the</p>

Competence code	Competence descriptor	Competence formation indicators (within this course)
		<p>technical condition</p> <p>SPC-4.3 Has the skills to perform verification calculations, taking into account the identified defects; assessment of the mutual influence of various defects on the technical condition of the control object; determining the need for additional research in order to clarify the determining parameters of the technical condition; development of measures to reduce operational risks based on risk analysis, minimization of operational risks</p>
SPC-6	Capable of applying the basic principles of rational use of natural resources and environmental protection	<p>SPC-6.1 Knows the legal and methodological framework of the procedure for conducting environmental impact assessment EIA and environmental expert activities for use in professional activities; fundamentals of the theory and normative legal acts of the integrated development and rational use of natural resources and environmental protection; the procedure for conducting a geological examination of projects, regulatory documents for compiling an environmental passport</p> <p>SPC-6.2 Can assess the state of the environment when conducting complex geological and geographical studies; use mechanisms for the rational use of natural resources and environmental protection; apply regulatory and methodological documents to assess and prevent environmental damage at production facilities</p> <p>SPC-6.3 Has the methodology of rational use of natural resources and environmental protection; a system of methods (EIA) and conducting state environmental expertise for successful research and production activities; skills and knowledge to assess environmental damage at production facilities, modern methods for eliminating the consequences and preventing environmental damage at production facilities</p>
SPC-7	Able to organize, manage, and carry out quality control of the main types of work in the development of oil and gas fields, transportation and processing of oil and gas	<p>SPC-7.1 Knows:</p> <p>The main types of applied systems for assessing the quality of geological types of work in the development of oil and gas fields, transportation and processing of oil and gas; ISO-9001 quality system, GKZ regulations and classification of oil and gas reserves</p> <p>Requirements of regulatory legal acts of the Russian Federation, local regulations, administrative documents and technical documentation in the field of hydrocarbon production</p> <p>Technological processes of hydrocarbon production</p> <p>Purpose, device and principle of operation of equipment for the extraction of hydrocarbon raw materials</p> <p>Physical and chemical properties of hydrocarbon raw materials, chemical reagents, the procedure and rules for their disposal</p> <p>Technological modes, well operation parameters</p> <p>Standards for technological losses of hydrocarbon raw materials during production in accordance with the accepted scheme and development technology</p> <p>The influence of various processes occurring in the reservoir on the productivity factor of a production well</p> <p>The procedure for measuring the productivity factor of a production well</p>

Competence code	Competence descriptor	Competence formation indicators (within this course)
		<p>Methods for calculating the productivity factor and skin effect according to well surveys with recording the pressure recovery curve</p> <p>Purpose, device and principle of operation of equipment for mechanized production of hydrocarbon raw materials</p> <p>Standards, specifications, guidelines for the development and execution of technical documentation</p> <p>Types of emergencies during well operation, their causes and methods of prevention and elimination</p> <p>Structure, interaction of means of an automated process control system, telemechanics, automatic control systems for hydrocarbon production equipment, ways to control them</p> <p>Requirements for labor protection, industrial, fire and environmental safety</p> <p>SPC-7.2 Can:</p> <p>Organize and conduct quality control of work in the development of oil and gas fields, transportation and processing of oil and gas at different stages of the study of specific objects</p> <p>Evaluate the residual life of hydrocarbon production equipment</p> <p>Analyze inflow characteristics in a vertical, horizontal or multilateral well</p> <p>Predict the change in the inflow characteristics from the reservoir to the well, taking into account the reservoir operation mode</p> <p>Develop operating instructions for hydrocarbon production equipment</p> <p>Control the operation of equipment for artificial lift of hydrocarbons</p> <p>Identify wells operating with deviations from the planned regime</p> <p>Conduct emergency drills with subordinate personnel according to the action plan for localization and elimination of accidents and incidents at hydrocarbon production facilities</p> <p>SPC-7.3 Has:</p> <p>The methodology for assessing the quality of all types of work in the development of oil and gas fields, transportation and processing of oil and gas at different stages of the study of specific objects</p> <p>Skills for organizing and monitoring the implementation of plans and tasks for the extraction of hydrocarbons</p> <p>Skills for operational management of production and monitoring compliance with hydrocarbon production technology</p> <p>Skills for monitoring compliance with the specified operating mode of well equipment, piping, oil and gas field pipelines, prefabricated pipelines, gas pipelines, pipelines, inhibitor pipelines in accordance with the requirements of the technological regulations of the installation, operating instructions and passports of equipment manufacturers</p> <p>Skills to analyze the dynamics of hydrocarbon production.</p> <p>Organization of providing jobs with up-to-date technological documentation</p>

Competence code	Competence descriptor	Competence formation indicators (within this course)
		Skills in organizing monitoring and control of the operation of the field and wells Skills of control and management of work on the preparation and maintenance of technical documentation of the unit Skills of control and management in the direction of compliance with the requirements of labor protection, industrial, fire and environmental safety in the unit Skills to control and manage the preparation of reports on the production of hydrocarbons

3. ACADEMIC PROGRAMME STRUCTURE

The course refers to the variable component of (B1) block of the higher educational programme curriculum.

Table 3.1. The list of the higher education programme components that contribute to the achievement of the expected learning outcomes as the course results

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
SPC-4	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	<i>Advanced oil and gas processing equipment and product quality management**;</i> Fundamentals of construction and operation of pipeline transport; Machinery and equipment for field development and transportation of hydrocarbons; Technological practice (educational) / Технологическая практика (учебная); Technological practice (industrial) / Технологическая практика (производственная);	Pre-graduation Practical Training;
SPC-6	Capable of applying the basic principles of rational use of natural resources and environmental protection	<i>Machinery and equipment for field development and transportation of hydrocarbons;</i> <i>Modern aspects of geological and geophysical research in the oil and gas industry;</i>	Pre-graduation Practical Training;
SPC-7	Able to organize, manage, and carry out quality control of the main types of work in the development of oil and gas fields, transportation and processing of oil and gas	<i>Technological practice (educational) / Технологическая практика (учебная);</i> <i>Machinery and equipment for field development and transportation of hydrocarbons;</i> <i>Modern aspects of geological and geophysical research in the oil and gas industry;</i>	

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
		<i>Modern stream in oil and gas processing in Russia**;</i> <i>Technologies for developing prospective hydrocarbon reserves;</i> <i>Technological practice (industrial) / Технологическая практика (производственная);</i>	

* - filled in in accordance with the matrix of competencies and the Higher Education Programme

4. COURSE WORKLOAD

The total workload of the course "Methods of oil production intensification / Методы интенсификации добычи нефти" is 5 credits.

Table 4.1 Types of academic activities during the period of the HE programme mastering

Type of study work	TOTAL, acc.hrs.	Semester(s)
		3
<i>Contact academic hours, acc .</i>	54	54
including:		
Lectures	18	18
Laboratory work		
Seminars (workshops/tutorials)	36	36
<i>Self-study (ies), academic hours</i>	99	99
<i>Evaluation and assessment (exam or pass/fail grading)</i>	27	27
The course total workload	acc.hrs.	180
	credits .	5

5. COURSE MODULE and CONTENTS

Table 5.1. The content of the discipline (module) by type of educational work

Name of the section (topic) of the discipline	Contents of the section (topic)	Type of study work
Section 1. Well productivity management. v	Goals of well productivity and injectivity management. Ways to intensify the operation of production and injection wells. Difference between enhanced oil recovery methods and well productivity control methods	Lecture, Lab work
Section 2. Processes occurring in the bottomhole formation zone.	Reasons for the decline in productivity and injectivity of wells. Processes taking place in the BHZ during field development	Lecture, Lab work
Section 3. Acid treatment of wells	Types of acid treatments, their advantages and disadvantages, scope. Pilot-industrial implementation and evaluation of the effectiveness of acid treatments.	Lecture, Lab work
Section 4. Hydraulic fracturing (HF).	Types of hydraulic fracturing, their advantages and disadvantages, scope.	Lecture, Lab work

	Pilot-industrial implementation and evaluation of the effectiveness of acid treatments.	
Section 5. Other technologies for increasing productivity and injectivity of wells	Horizontal wells as a method to increase the productivity and injectivity of wells. Wave action on the reservoir. Thermal methods of oil production stimulation	Lecture, Lab work
Section 6 . Enhanced oil recovery methods	Reasons for the formation of residual oil saturation. Classification of methods for enhanced oil recovery. Pilot-industrial implementation.	Lecture, Lab work

6.CLASSROOM EQUIPMENT and TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom Equipment and Technology Support Requirements

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary)
Lecture	Training room for conducting lecture-type classes: room. No. 335 A set of specialized furniture; technical means: projection screen; multimedia projector SANYO PROxtraX ; system block DEPO Neos 220	
Seminar	Classroom for conducting seminar-type classes: room. No. 356 A set of specialized furniture; chalk board; monitor NEC PLASMA MONITO MODEL PX-42XM1G; system block DEPO Neos 220	
For self-study	Classroom for conducting seminar-type classes: room. No. 356 A set of specialized furniture; chalk board; monitor NEC PLASMA MONITO MODEL PX-42XM1G; system block DEPO Neos 220	

7. RESOURCES RECOMMENDED FOR COURSE

Main reading(sources):

1. Modern technologies for intensifying the production of high-viscosity oil and evaluating the effectiveness of their application: [16+] / D.G. Antoniadi , A.M. Gaponenko, G.T. Vartumyan , Yu.G. Streltsov. - Moscow ; Vologda: Infra-Engineering, 2019. - 421 p. ISBN 978-5-9729-0356-6. 1. - URL : <http://biblioclub.ru/index.php?page=book&id=564394>

2. Fedin L. M., Fedin K. L., Fedin A. K. Fundamentals of enhanced oil recovery of heavy oil [[Text]] / Fedin L. M., Fedin K. L., Fedin A. K. [Electronic resource]. - Simferopol: Share, 2013. 111 p . ISBN 978-966-366-630-3

URL:

<http://dlib.rsl.ru/rsl01008000000/rsl01008524000/rsl01008524196/rsl01008524196.pdf>

Additional(optional) reading (sources):

1. Oparin V.N. Geomechanical and technical bases for enhanced oil recovery in vibrowave technologies: Monograph / V.N. Oparin, Simonov Boris Ferapontovich and others; Rep. ed. V.V. Ivashin . - Novosibirsk: Nauka, 2010. - 404 p. - ISBN 978-5-02-023312-6 : 0.00.

Internet sources

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

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

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- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" <http://e.lanbook.com/>
- EL "Trinity Bridge"

Learning toolkits for self- studies:

1. A course of lectures on the course "Methods for intensifying oil production".
2. Guidelines for students on the development of the course "Methods for intensifying oil production".

*The training toolkit and guidelines for the course are placed on the course page in the university telecommunication training and information system under the set procedure.

3. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL AS COURSE RESULTS

The assessment toolkit and the grading system* to evaluate the level of competences (competences in part) formation as the course results are specified in the Appendix to the course syllabus.

* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

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