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**Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University
Academy of Engineering**

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

COURSE SYLLABUS OF THE DISCIPLINE

**Resource estimation, computation and recalculation of hydrocarbon reserves /
Оценка ресурсов, подсчет и пересчет запасов углеводородов**

(name of discipline/module)

Recommended by the Didactic Council for the Education Field:

21.04.01 Oil and gas engineering

(code and name of the Higher Education Field)

The development of the discipline is carried out within the framework of the implementation of the higher education program of higher education (Higher Education Program):

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

(name (profile/specialization) of the Higher Education Program)

1. COURSE GOALS

The purpose of mastering the discipline "Resource estimation, computation and recalculation of hydrocarbon reserves / Оценка ресурсов, подсчет и пересчет запасов углеводородов" is to form students' basic knowledge in the field of classification and calculation of reserves, assessment of hydrocarbon resources in Russia and a number of foreign countries and regions, as well as mastering various methods of calculating reserves and estimating resources. The study of the discipline allows you to significantly improve the quality of training graduates for subsequent practical work and solving problems of both geological and field research, and the operation and maintenance of oil production facilities.

2. LEARNING OUTCOMES

Mastering the discipline "Estimation of resources, calculation and recalculation of hydrocarbon reserves" is aimed at developing the following competencies (parts of competencies):

Table 2.1. The list of competencies formed by students in the course of mastering the discipline (the results of mastering the discipline)

Competence code	Competence	Competence indicators (within this discipline)
GPC-3	Able to develop scientific and technical, design and service documentation, draw up scientific and technical reports, surveys, publications, reviews	GPC-3.1. Knows methods for evaluating the types of entrepreneurial activities used in the enterprise. GPC-3.2. Can use the basics of logistics, in relation to an oil and gas enterprise, when the main technological operations are performed in conditions of uncertainty: put into practice the elements of production management; use the opportunities for entrepreneurial activities at the entrusted facility and its legislative regulation; find the possibility of combining the performance of basic duties with elements of entrepreneurship. GPC-3.3. Has the skills of personnel management in a small production unit.
SPC-2	Able to develop and implement new advanced technologies in the field of geological exploration, evaluation and estimation of hydrocarbon raw materials	SPC-2.1 Knows the methodological provisions, instructions and requirements for the geological study of the subsoil and geological exploration: the reserve estimation management policy; rules for compiling documentation in the field of reserves estimation and management; technologies for conducting, processing and interpreting geological and geophysical works; exploration technologies; national and global trends in the development of advanced technologies SPC-2.2 Can manage the production activities of the entrusted structural unit; check the design documentation for compliance with the requirements of existing norms and rules; introduce advanced technologies in the process of prospecting and exploration of oil and gas fields; develop proposals and take prompt measures aimed at improving the quality of activities work SPC-2.3 Has the skills for studying Russian and foreign experience in matters of assessing and managing reserves; skills for preparing proposals for new methods and technologies in the field of geological exploration and reserve estimation; the skills for supervising the execution of case studies and research and development activities

Competence code	Competence	Competence indicators (within this discipline)
SPC-3	Able to assess resources, calculate estimate and recalculate reestimate hydrocarbon reserves for the preparation of scientific and technological projects planning.	<p>SPC-3.1 Knows the current legislative, regulatory legal acts of the Russian Federation, norms and rules in the field of assessing reserves and managing reserves; regulations, provisions, instructions and standards of the organization reserve estimation counting and management; rules for compiling documentation for ongoing exploration programs; rules for compiling documentation for prospective exploration programs; rules for drawing up planning documentation; norms and rules for the development of project documentation; the quality policy of the organization in the field of geological exploration; technologies for conducting, processing and interpreting geological and geophysical works; features of geological exploration</p> <p>SPC-3.2 Can develop recommendations for further study of the deposit to clarify the geological structure and reserves; apply the requirements of regulatory documents in the assessment of hydrocarbon resources and reserves; prepare materials used in the development of exploration programs for the reserve estimation and management; draw up documentation for current and prospective exploration programs; analyze the quality of current exploration programs for reserve estimation and management; control the implementation and results of the development of current and prospective work programs for reserve estimation and management.</p> <p>SPC-3.3 Has the skills to analyze and evaluate the organization's resource base; skills in the development of current and prospective programs of geological exploration in order to clarify hydrocarbon reserves in the territory of the organization; the skills for high-quality and timely estimation (re-estimation) of reserves for individual objects; the skills for preparation in the established order of operational reporting</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>

Competence code	Competence	Competence indicators (within this discipline)
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> <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</p>

Competence code	Competence	Competence indicators (within this discipline)
		regime Conduct emergency drills with subordinate personnel according to the action plan for localization and elimination of accidents and incidents at hydrocarbon production facilities SPC-7.3 Has: 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 Skills for organizing and monitoring the implementation of plans and tasks for the extraction of hydrocarbons Skills for operational management of production and monitoring compliance with hydrocarbon production technology 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 Skills to analyze the dynamics of hydrocarbon production. Organization of providing jobs with up-to-date technological documentation 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 PROGRAM STRUCTURE

The discipline " Resource estimation, computation and recalculation of hydrocarbon reserves / Оценка ресурсов, подсчет и пересчет запасов углеводородов " refers to the Compulsory (Disciplines) Module of block B1 of the Higher Education Program.

As part of the Higher Education Program, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline " Estimation of resources, calculation and recalculation of hydrocarbon reserves ".

Table 3.1. List of Higher Education Program components / disciplines that contribute to expected learning/training outcomes

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
GPC-3	Able to develop scientific and technical, design and service documentation,	Technological processes of pipeline transport / Технологические процессы	Information technologies in the oil and gas industry / Информационные технологии в

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
	draw up scientific and technical reports, surveys, publications, reviews	трубопроводного транспорта	нефтегазовом комплексе Technological practice (training) / Технологическая практика (учебная) Technological practice (educational) Research work (obtaining primary skills in research work) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) Technological practice (production) / Технологическая практика (производственная) SFC
SPC-2	Able to develop and implement new advanced technologies in the field of geological exploration, evaluation and estimation of hydrocarbon raw materials	-	Research work (obtaining primary skills in research work) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) Research work / Научно-исследовательская работа Pre-graduate practice / Преддипломная практика SFC
SPC-3	Able to assess resources, calculate estimate and recalculate reestimate hydrocarbon reserves for the preparation of scientific and technological projects planning.	-	Improving the efficiency of the production process and operation of equipment for the extraction of hydrocarbons / Повышение эффективности процесса добычи и работы оборудования по добыче углеводородного сырья Research work (obtaining primary skills in research work) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) Research work / Научно-исследовательская работа SFC
SPC-6	Capable of applying the basic principles of rational use of natural resources and environmental protection	Modern aspects of geological and geophysical research in the oil and gas industry / Современные аспекты геолого-промысловых и геофизических исследований в нефтегазовом деле Machinery and equipment for field development and	Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире Oil production stimulation methods Technologies for the development of promising hydrocarbon

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
		transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов	reserves Technological practice (training) / Технологическая практика (учебная) Technological practice (production) / Технологическая практика (производственная) Pre-graduate practice / Преддипломная практика SFC
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	Modern aspects of geological and geophysical research in the oil and gas industry / Современные аспекты геолого-промысловых и геофизических исследований в нефтегазовом деле Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов	Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире Methods of oil production intensification / Методы интенсификации добычи нефти Technologies for developing prospective hydrocarbon reserves / Технологии разработки перспективных запасов углеводородов Pre-graduate practice / Преддипломная практика SFC

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

4. COURSE WORKLOAD and ACADEMIC/TRAINING/LEARNING ACTIVITIES

The total workload of the discipline " Resource estimation, computation and recalculation of hydrocarbon reserves / Оценка ресурсов, подсчет и пересчет запасов углеводородов " is equal to 3 credits.

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

Type of study work	TOTAL , acc.hrs.	Semester(s)			
		one	2	3	4
Contact academic hours, acc .	48	-	48	-	-
including:					
Lectures (16	-	16	-	-
Laboratory work	-	-	-	-	-
Seminars (workshops/tutorials)	32	-	32	-	-
Self-study (ies), academic hours	51	-	51	-	-
Evaluation and assessment (exam or pass/fail grading)	9	-	9	-	-
The course total workload	acc.hrs.	108	-	108	-
	credits.	3	-	3	-

5. COURSE MODULE and CONTENTS

- Table 5.1. Classroom Equipment and Technology Support Requirements

Name of the discipline section	Contents of the section (topic)	Type of study*
Section 1. Goals and objectives of the discipline. Geological and economic assessment of the main regions producing hydrocarbons	Topic 1.1. Natural reservoirs and traps, concepts and classifications. Deposits, classes of deposits and classification by phase state of hydrocarbons.	Lecture, Lab work
	Topic 1.2. Natural regime, types of regimes in oil and gas deposits. Oil and gas fields, classification features, classification of fields by the size of recoverable oil reserves and geological gas reserves and by the complexity of the geological structure.	Lecture, Lab work
	Topic 1.3. OPEC countries. Geological and economic assessment of the regions of countries producing hydrocarbons: North and South America (Canada, Brazil), Africa (Morocco, Egypt, Congo, Israel), European countries (France, Italy), China, Australia	Lecture, Lab work
Section 2. Classification of reserves and resources of oil and gas	Topic 2.1. The history of the development of classifications of oil and gas reserves. Temporary classification of field reserves, prospective and forecast resources of oil and combustible gases, its essence.	Lecture, Lab work
	Topic 2.2. Classifications of oil and gas reserves used in the oil world, comparison of classification systems of reserves and resources of oil and gas in different countries.	Lecture, Lab work
Section 3. Exploration work in oil and gas fields	Topic 3.1. Exploration process, its essence. Stages and stages of exploration work. Regional stage, its stages, objects of work, typical complex of work and results of work.	Lecture, Lab work
	Topic 3.2. Search and evaluation stage, its stages, objects of work, a typical complex of work and results of work. Exploration stage, its stage, objects of work, typical complex of work and results of work.	Lecture, Lab work
Section 4. Categories of reserves and resources, their purpose.	Topic 4.1. The concept of stocks and resources. Conditions for assigning reserves and resources to different categories. Categories of reserves and resources according to geological knowledge, their purpose. Groups of oil and gas reserves and basic principles of calculation and accounting.	Lecture, Lab work
	Topic 4.2. Estimated plans, their essence. The relationship of categories of reserves and resources with the stages and stages of exploration and development of deposits. Total resources of oil, gas and condensate.	Lecture, Lab work
Section 5. Calculation of oil and free gas reserves by volumetric method.	Topic 5.1. Volumetric method for calculating oil reserves, its essence. Volumetric method for calculating free gas reserves, its essence. Methods for determining the average values of the calculated parameters of deposits, the geometrization of the calculated parameters according to the section of wells and the area of deposits, types of data averaging, determining the average values of porosity coefficients, oil and gas saturation and effective oil and gas pay thickness.	Lecture, Lab work
	Topic 5.2. Determination of parameters of productive formations by reservoir intersections in wells. Identification of reservoirs by qualitative features, quantitative criteria and structure of the pore space.	Lecture, Lab work
	Topic 5.3. Evaluation of the saturation character according to the data of mud logging, core, well logging, test results during drilling and in the column. Determination of porosity according to core and logging data.	Lecture, Lab work
	Topic 5.4. Determination of oil and gas saturation	Lecture,

Name of the discipline section	Contents of the section (topic)	Type of study*
	coefficients from core and logging. Determination of permeability from core data, logging and test results. Determination of physical and chemical properties and parameters of oils, hydrocarbon gases, condensates and formation waters.	Lab work
	Topic 5.5. Main stages of calculation of oil and free gas reserves. Calculation of oil and free gas reserves at the stage of exploration and evaluation, upon completion of the exploration stage, in developing deposits. Calculation of oil and free gas reserves in complex reservoirs.	Lecture, Lab work
	Topic 5.6. Calculation of oil and free gas reserves in gas-oil and oil-and-gas deposits. Construction of a geological model of the deposit, correlation of well sections and geometrization of oil and gas deposits.	Lecture, Lab work
Section 6. Material balance method for calculating oil and free gas reserves. Calculation of oil reserves by statistical method.	Topic 6.1. Principles of the material balance method. The material balance method for calculating oil reserves under various reservoir operation modes. Calculation of free gas reserves by pressure drop method.	Lecture, Lab work
	Topic 6.2. Principles of the statistical method. Statistical method for calculating oil reserves, types of statistical dependencies.	Lecture, Lab work
Section 7. Methods for calculating geological and recoverable reserves of gas, condensate, ethane, propane, butanes and useful components dissolved in oil. Methods for determining recoverable oil and gas reserves at various stages of exploration of deposits.	Topic 7.1. Calculation of reserves of gas dissolved in oil under various operating conditions of the deposit. Methods for calculating geological and recoverable condensate reserves. Calculation of geological reserves of ethane, propane, butanes, hydrogen sulfide and other useful components.	Lecture, Lab work
	Topic 7.2. Determination of recoverable reserves and oil and condensate recovery factors at various stages of exploration of fields (deposits). Substantiation of oil recovery factors depending on the stages of exploration, operating modes and complexity of the geological structure of deposits (deposits).	Lecture, Lab work
	Topic 7.3. Methods for calculating recoverable reserves and oil recovery factors, the essence of statistical, extrapolation and hydrodynamic methods. Calculation of recoverable reserves at various stages of exploration of deposits. The concept of the gas recovery factor.	Lecture, Lab work
Section 8. Recalculation (recalculation) of reserves. Assessment of prospective and predictive resources.	Topic 8.1. Transfer of stocks to higher categories. Peculiarities of recalculation of oil, gas and condensate reserves of deposits under development.	Lecture, Lab work
	Topic 8.2. Evaluation of prospective resources, determination of calculation parameters.	Lecture, Lab work
	Topic 8.3. Estimation of forecast resources, principles of qualitative and quantitative assessment of oil and gas potential. Separate forecasting of oil and gas content.	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. Recommended Sources for Course Studies

Main reading(sources):

1. Burkhanov R.N., Gurevich V.M. , Burkhanova G.R., Sabirzyanova Z.M. Deposit geometrization and calculation of oil and associated gas reserves: a teaching aid for laboratory work, practical exercises and independent work of students of all forms of education. - Almetyevsk: Almetyevsk State Oil Institute, 2009. - 58p.
2. Methodological recommendations for calculating the geological reserves of oil and gas by volumetric method / ed. IN AND. Petersilie , V.I. Poroskuna , GG. Yatsenko. M.: Tver: VNIMI, SPC " Tvergeofizika ", 2003. - 262 p.
3. On the approval of guidelines for the application of the Classification of reserves and resources of oil and combustible gases, approved by order of the Ministry of Natural Resources and Ecology of the Russian Federation dated 01.11.2013 No. 477

Additional(optional) reading (sources):

1. Zhdanov M.A. Oilfield geology and calculation of oil and gas reserves. M.: Nedra, 1981. - 453 p.
2. Zimina SV. Geological foundations for the development of oil and gas fields: Textbook. Tomsk: Publishing House of TPU, 2004. - 175 p.
3. Ivanova M.M. , Cholovsky I.P., Gutman I.S., Vagin SB., Bragin Yu.I. Oilfield geology and hydrogeology of hydrocarbon deposits. M.: Oil and gas, 2002. - 455 p.
4. Methodological guidance on the calculation of the oil recovery factor from the bowels. RD 39-0147035-214-86. M., 1986. -73 p.
5. Instructions on the application of the classification of field reserves, prospective and forecast resources of oil and combustible gases (October 14, 1983, 14 pages)
6. Methodological guidelines for the quantitative assessment of forecast resources of oil, gas and condensate. M.: VNIGNI, 1983. - 96 p.
7. Calculation of reserves of oil, gas, condensate and components contained in them: reference book / ed. VV. Stasenkova , I.S. Gutman. M.: Nedra, 1989. - 270 p.

Internet-(based) sources:

- 1. Electronic libraries with access for RUDN students:

RUDN Electronic Library System - RUDN EBS <http://lib.rudn.ru/MegaPro/Web>

- ELS "University Library Online" <http://www.biblioclub.ru>

- EBS Yurayt <http://www.biblio-online.ru>

- ELS "Student Consultant" www.studentlibrary.ru

- EBS "Lan" <http://e.lanbook.com/>

- EBS "Trinity Bridge"

- Electronic fund of legal and regulatory documents

<https://docs.cntd.ru/document/420341279>

2. Databases and search engines:

- electronic fund of legal and normative-technical documentation <http://docs.cntd.ru/>

- Yandex search engine <https://www.yandex.ru/>

- Google search engine <https://www.google.ru/>

- abstract database SCOPUS <http://www.elsevier.com/locate/scopus/>

Learning toolkits for self- studies in the RUDN LMS TUIS:

1. A course of lectures on the discipline "Estimation of resources, calculation and recalculation of hydrocarbon reserves".

2. Guidelines for students on mastering the discipline "Estimation of resources, calculation and recalculation of hydrocarbon reserves."

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of the discipline **in TUIS!**

8. EVALU ASSESSMENT AND EVALUATION TOOLKIT

Marking criteria (MC) and a 100-point (score) scale for assessing the level of competencies (part of competencies) based on the results of mastering the discipline "Estimation of resources, calculation and recalculation of hydrocarbon reserves" are presented in the Appendix to this Work Program of the discipline.

* - MC and the 100-point (score) are formed on the basis of the requirements of the relevant local normative act of the Peoples' Friendship University of Russia.

DEVELOPERS:

Associate Professor of the Department of Mineral
Developing and Oil&Gas Engineering

Position, Department

Signature

Tyukavkina O.V.

Full name

Head of Department:

Director of the Department of Mineral
Developing and Oil&Gas Engineering

Name of Department

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Kotelnikov A.E.

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Head of Educational Programme:

Professor of the Department of Mineral
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Kapustin V.M.

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