REPUBLIC OF UZBEKISTAN
MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS

NAMANGAN ENGINEERING CONSTRUCTION INSTITUTE

NamMQI
O'quv-uslubiy boshqarma
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"I APPROVE"
Vice-rector for academic affairs
_____ Q. Inoyatov
2023 "___"

"Geophysical methods of oil and gas exploration"

SCIENCE CURRICULUM

Fields of knowledge:	700000 – Engineering, processing and construction industries
The field of education:	720000- Production and processing areas
Fields of study:	60721600 – Geology, exploration and exploration of mineral deposits (by types of deposits)

Namanagan-2023

Subject/module code NGKIG3608	Academic year 2023-2024	Semestr 5/6	ECTS – Credits 4/4
Science module type Mandatory	Language of education Uzbek/Russian		Class hours per week 4/4

	The name of the subject	Auditorium training (hour)	Independent education (hour)	Total download (hour)
1.	Oil and gas fields geophysical search methods	120	120	240

2. **2.1 Purpose and tasks of teaching science**

The purpose of teaching science is to know different methods of prospecting and prospecting for mineral deposits. Geophysical methods have specific tasks and functions. It is no exaggeration to say that geophysical methods play the most important role in all stages of prospecting.

The information obtained based on the application of geophysical methods complements the information of other methods and is of serious importance in making appropriate decisions. For example, radiometric and nuclear geophysical methods have great potential for solving various geological tasks. Geological mapping, study of the geological structure, lithology, density, radioactivity, chemical properties of deposits, determination of the composition of mineral deposits cannot be completed without the methods of gravity exploration, magnetic exploration, electro-exploration.

The task of the science is the methods of studying the physical field, the structure of the earth's surface and the main geophysical elements, the main features and characteristics of geophysical methods in solving geological problems, the stages of geological mapping and imaging of the studied areas at what scales, geophysical imaging, aerophotocosmic, marine and terrestrial geophysics to teach the theoretical and practical knowledge of the method in order and continuity, to have ideas about the methodology of conducting field geophysical work and laboratory work, to process and interpret the data obtained in the equipment used in the field geophysical work, to know and be able to use the organization of field work, methods of conducting field work and computer processing of received data, monitor the quality of primary field data, analyze data, prepare report materials on the results of field work It consists of teaching theoretical and practical knowledge in unity and continuity.

2.2. The main theoretical part (lectures)

The subject includes the following topics:

Topic 1. General description of geophysical methods and their role in solving problems of oil and gas geology.

In order to successfully apply geophysical methods, it is necessary to know the physical properties of rocks. Geophysical methods are based on the study of natural or artificially created physical fields that reflect the physical properties of rocks or sediments.

Topic 2. Brief description of geophysical methods and their classification.

The methods of seismic surveying and electrical surveying are widely used in solving problems of oil and gas geology. But gravity exploration, magnetic exploration, and nuclear geophysical methods are also important. Geophysical studies of wells used at all stages of exploration and exploration, which are carried out along with drilling of wells, occupy a special place.

Topic 3. Physico-geological foundations of the use of geophysical methods.

Using geophysical methods, it is possible to quickly explore large areas in favorable geological conditions and find minerals at depth. With their help, it is possible to determine its location, and sometimes its depth and size.

Topic 4. The role of geophysical methods in the stages of exploration, study and exploitation of oil and gas deposits.

The importance of geophysical methods in the development of the national economy is particularly evident in the case of oil and gas exploration. Geophysical methods are the most widely used and effective in this field. In order to meet the ever-increasing demand for oil and gas, their search and exploration activities are intensifying in all countries of the world.

Topic 5. Seismological survey. Theoretical elements of seismology. Fundamentals of wave types and geometric seismicity. Hodograph of seismic wave.

Seismological surveying is a geophysical method of searching for and studying the geological structure of regions, minerals, based on the study of the propagation of elastic waves in the geological environment. The theoretical basis of the variants of this method specialized in the search for oil and gas deposits are almost the same as those in other areas, the differences are in the tasks to be solved and the monitoring systems for solving them, and the features of field work.

Topic 6. Seismic wave sources and receiving devices. Seismological survey methods and monitoring systems.

The method of seismic drilling is based on the propagation laws of seismic (elastic mechanical) waves in the geological environment, for which a whole theory - the theory of propagation of elastic (seismic) waves - has been developed. This theory is based on the theory of ductility, since to a first approximation the geological environment can be considered ductile.

Topic 7. Processing and interpretation of seismic data. Attributes of seismic surveying. Attribute analysis.

In seismic exploration, various methods are used to excite seismic waves: explosive, impact, vibrators, etc. To receive signals, receivers (seismic receivers) connected to a complex of signal amplification, filtering and processing equipment are used.

Complex equipment and equipment sets divided into four groups are used for seismic research: 1) sources of wave generation; 2) wave reception and processing

equipment - seismic stations, including multi-channel amplifiers and recorders (analog or digital); 3) computer data processing complex; 4) auxiliary machinery and equipment (drilling rigs, vehicles for transporting receiver units, wires, etc.).

Topic 8. Application of seismic surveying in search of oil and gas structures.

The main goal of seismic research in solving the problems of oil and gas geology is to search for local structures where oil and gas deposits can accumulate. These structures are called handles. Generally, reservoir rocks should have porosity, high permeability, and other reservoir properties.

Topic 9. Electronic intelligence. Electrical properties of rocks and types of electromagnetic fields used in electroresearch.

Electroprospecting (or electromagnetic prospecting) is a geophysical method based on the study of the electromagnetic properties of the geological environment in the study of the geological structure of the Earth, in the search and study of mineral deposits.

Topic 10. Solutions of direct and inverse problems of electroreconnaissance.

The physico-mathematical theory of electroreconnaissance is based on the theory of constant and changing electromagnetic fields. Electrointelligence theory is based on Maxwell's equations. If the geoelectric cross-section is known, then with the help of differential equations and physical conditions derived from the system of Maxwell's equations, the correct problems of electroresearch for physical-geological models of the environment are solved, that is, for one or another component of the fields on such models analytical expressions are found.

Topic 11. Basic methods of electronic intelligence. Electronic intelligence equipment and devices.

Electroresearch methods are based on observing and studying the properties of electromagnetic fields of natural or artificial origin due to the physical properties of rocks (electrical conductivity, dielectric constant, magnetic permeability, inductive polarization, etc.).

Topic 12. Interpretation of electronic intelligence data. Use of electronic reconnaissance in the search for oil and gas deposits.

Qualitative and quantitative interpretation of data is carried out on the basis of observation materials in electronic intelligence. Qualitative interpretation is carried out based on visual identification of anomalies created by the studied objects, with an assessment of their presence, location and size. Quantitative interpretation determines the depths, geometric dimensions and electromagnetic properties of the studied objects. The final result of qualitative and quantitative interpretation is geological interpretation of anomalies. For this purpose, all possible geological information was involved.

Topic 13. Gravity exploration. General concepts and main theoretical aspects of gravity exploration. The weight of rocks. Earth's mass and density.

In this topic, we will focus on the main concepts and definitions of gravity prospecting, briefly consider the main theoretical aspects: gravity and free fall acceleration, free fall potential and its derivatives, anomalies and gravity reductions, rock density and the possibilities of graviexploration in solving geological tasks are described.

Topic 14. Measurement methods and equipment of gravity exploration. Research methods of gravity exploration.

There are two types of gravity measurement methods - dynamic and static. Dynamic methods are based on monitoring the movement of the load in the weight field. In this case, the measurement quantity is time. In static methods, a change in the equilibrium state of the body is observed under the influence of gravity and other opposing forces. In this case, the measured value is the linear or angular displacement of the object. Springs, threads, membranes, etc. can be used as a counter-acting force.

Topic 15. Interpretation of gravitational anomalies. Solutions of correct and inverse problems. Application of gravity exploration in oil and gas geology.

Interpretation of gravity prospecting data (like other geophysical methods) is based on physical-mathematical and geological modeling data. It is required to develop a model that includes the analysis of gravity anomalies with mandatory use of known geological-geophysical and petrophysical (density) data about the studied area. At this stage, ready-made solutions of correct and inverse problems obtained on the examples of bodies of different shapes will help.

Topic 16. Theoretical basis of magnetic probe. Magnetic properties of rocks.

The Earth's magnetic field is formed due to processes related to its internal structure, different rotation speeds of the outer and inner core, so it is observed everywhere. The Earth's magnetic field is influenced by the solar wind and has an asymmetric shape of the field lines. This magnetic field of the Earth is primary and is called the normal geomagnetic field. At the same time, during observations on Earth, differences in the value of the area in different regions were noted. The deviation from this normal value (anomaly) is related to differences in the internal structure of the earth's crust.

Topic 17. Principles and tools of measuring geomagnetic fields. Methodology of field observations of magnetic probe.

The beginning of measuring the magnetic field can be dated to the time of the first compass, although the compass only determined the direction to the north or south magnetic poles.

Topic 18. Application of magnetic probe in search of oil and gas fields.

It should be noted that magnetic prospecting in combination with other geophysical methods (for example, gravimetric and seismometric prospecting) gives good results for solving regional and detailed structural-geological tasks.

The magnetic prospecting method is used in mapping large zones of large uplifts, depressions and bends, bends between edges and mountains, in determining vertical fault zones and their internal structure, in studying the structural features of the crystallized foundation, in assessing its physical properties, composition and structure, and used in surveying and mapping for many other tasks.

Topic 19. Physico-geological basis of thermoresearch. Of rocks thermal properties.

Thermal prospecting is a geophysical prospecting method that combines all available methods for studying the Earth's thermal field. It combines all physical methods aimed at studying the Earth's natural thermal field in order to study landscapes, the thermal regime of the earth's crust and upper mantle, identify geothermal resources, explore and solve engineering-hydrogeological tasks.

Topic 20. Geothermal monitoring equipment.

Thermometers are used to measure the temperature of rocks or the temperature of water in wells (spurs) or sediments at the bottom of the water. Such thermometers can have various sensors as a sensitive element. These are thermistors, semiconductor resistors-thermistors, thermosensitive piezoelectric crystals.

Topic 21. Thermal reconnaissance research methods.

The methods of sensing heat energy from the Earth's surface are divided into two types: radiothermal observations and infrared observations. They differ in the spectral range of heat waves. Their main advantage is that observations can be made in the dark, and with the right choice of wavelengths, observations can be made in any weather.

Topic 22. Conducting geothermal research in search of oil and gas fields to go

According to the model of mixgenetic synthesis of hydrocarbons, thermal masses form UV compounds during their movement due to the infiltration of juvenile gases and reaction with surrounding rocks. They are the main source of oil and gas. Under certain thermodynamic conditions, various chemical reactions occur, which lead to their formation and, under appropriate conditions, increase the concentration of organic compounds in the form of hydrocarbon piles.

Topic 23. Radioactivity. Distribution of radioactive elements in the lithosphere.

A set of geophysical methods based on nuclear-physical changes and phenomena and aimed at studying the radioactivity of rocks in natural lying conditions is combined under the generalized name of Radiometry and Nuclear Geophysics.

Modifications of radiometric search are: gamma method, gamma-spectral method, emanation, ionometric, beta method, neutron gamma method, etc. Radiometric methods used in geophysical research of wells are called radioactive logging.

Topic 24. Measuring devices and radiometric devices. Observation methodology and data interpretation.

In general, all devices that measure the intensity of radioactive radiation could be called radiometers. However, radioactivity should be taken into account not only natural and artificial, but also primary radiation from the source and secondary radiation from the irradiated object. Based on this information, devices that measure radioactivity are divided into two large groups - radiometers and dosimeters.

Topic 25. Application of radiometric methods in prospecting and exploration of oil and gas deposits.

Radiometric methods, among other methods, are used to study the geological structure of the prospective oil and gas region. The reason for this is that the radioactive elements in the rocks provide information about the type of rocks, the conditions of their formation and subsequent changes.

Topic 26. Specificity of QGT tasks and observations in oil wells. General classification of QGT methods.

Geophysical research of wells (QGT) is a set of geophysical methods aimed at monitoring the rocks in and around the wells, the environment between the wells, and the condition of the wells, studying various parameters at the stage of mine development. GIS has a special place and independent importance. QGT differs from field geophysical methods mainly in research methods and techniques.

Topic 27. Electroresearch methods of studying the geological section of wells (UzQP, JK, YK, YKZ, IK).

The types and tasks of QGTM are determined by the target direction of geological exploration, which is characterized by five stages: regional, detailed, exploration - study, detailed study and production. In these stages, we will briefly describe the role and functions of QGT.

Topic 28. Seismoacoustic methods of studying the geological section (SK, TSP, AK, MSK).

Seismic logging (SK) is a type of seismometric method based on measuring the time of arrival of seismic waves generated by an explosion or vibration close to the surface of the earth to a device that receives seismic waves (QP - reception point, seismopriomnik) located in a well. Vertical seismic profiling (VSP). Transcatheter sound hearing (QATE).

Topic 29. Radioactive methods of studying the geological section (GK, GGK, NK, NGK, NGK-S, NGK-P, NGK-NT).

Radiometric logging (RK) carried out in wells is usually also referred to as nuclear physics method (YFM). RK is a set of methods aimed at studying the radioactive properties of rocks with the help of natural and artificial (induced) radiation. Different RK methods are used to solve different geological tasks.

Topic 30. Studying the geological section and its collecting features. Comprehensive interpretation of QGT data.

At all stages of exploration, exploration and production of oil and gas fields, the comprehensive interpretation of geophysical survey data is important for solving the following tasks: opening and determining the boundaries of the field, studying its geological structure, identifying and exploring collectors in productive layers. in determining the basic parameters of collectors necessary for calculating reserves and drawing up a development project for oil and gas fields.

2.3. Instructions and recommendations for practical training.

The following topics are recommended for practical training:

1. To study the process of separation of stages and stages of the geological-exploration process for oil and gas.
2. Features of search and exploration of oil and gas reservoirs and principles of placement of exploration wells.
3. Nomenclature of drill wells in oil and gas exploration and their tasks.
4. Methods of correlating the cross section of drill wells.
5. Classification of local elevations.
6. Studying the appearance of local elevations using geological profiles.
7. Formation conditions of a stratigraphic type of trap.
8. Formation conditions of lithological and mixed types of traps.
9. Wells in the exploration of separate piles and exploration layers basic principles of deployment.
10. Methods of reconnaissance on a vertical section.
11. Principles of geological mapping in oil and gas exploration.
12. Thickness, paleostructure maps, profiles.
13. Prospective maps of Neftgaz.
14. Lithofacies and lithological maps.
15. Tectonic paleogeomorphological and paleogeological maps.
16. Use of scientific methods in the study of geology.
17. Drawing geological sections and stratigraphic columns.
18. Creating a card of structures.
19. Construction of well sections.
20. Comparison of well sections.
21. Study of genetic types of oil and gas deposits.
22. Studying the distribution of oil and gas accumulations in the earth's crust.
23. Study of oil and gas regions of Uzbekistan.
24. Stage of regional study of the oil and gas basin. Creating a general stratigraphic section, creating a seismo-geological section based on seismic data, forming a tectonic model.
25. Separation of the main development stages of the oil and gas basin and creation of paleoprofiles.
26. Separation of the main development stages of the oil and gas basin and creation of paleoprofiles.
27. Correlation with log charts and separation of potentially productive layers.
28. Correlating log charts and layering can be productive.
29. Predict well-calculated cutoff intervals for hydrocarbon generation, accumulation, and conservation.
30. Predict well-calculated cross-section intervals for hydrocarbon generation, accumulation, and conservation.

Practical training should be conducted by one professor-teacher for one academic group in an auditorium equipped with multimedia facilities. It is desirable that the classes should be conducted using active and interactive methods, appropriate pedagogical and information technologies should be used.

2.4. Instructions and recommendations for laboratory work:
Science laboratory work is not included in the model curriculum.

2.5. Instructions and recommendations on the course work (project).
Science coursework (project) is not provided for in the science model curriculum.

2.6. Independent education and independent work.
Recommended assignments for independent study:
1. Methods of searching for oil and gas deposits.
2. Methods of exploration of oil and gas deposits.
3. Search for oil and gas deposits and analysis of exploration work.
4. Rational methods of exploration of oil and gas fields.
5. Get acquainted with new articles in the Oil and Gas Journal of Uzbekistan.
6. Principles of placement of exploration wells.
7. Placement of exploration wells.
8. Choosing an intelligence system (system).
9. Research in the search and exploration process of oil and gas deposits.
10. Tasks and methods of regional oil gasification works.
11. Features of exploration of gas and gas condensate accumulations.
12. Exploration - geological charts in the exploration process.
13. Exploration of genetically diverse oil and gas reserves features.
14. Features of exploration of gas heaps.
15. Characteristics of gas condensate piles and the principles of placing a well in them.
16. Features and exploration of gas-oil deposits.
17. Oil and gas prospecting project.
18. Exploration project of oil and gas fields
19. Prospecting project during the exploitation of oil and gas deposits.
20. Design of foundation wells.
21. Assessment of oil and gas content of the field.
22. Preparing for drilling in search of promising fields for Neftgaz.
23. Designing regional studies to determine oil and gas accumulation areas.
24. Detailed studies to identify prospective oil and gas fields design.

3.	**Results of science education (competencies to be formed).** As a result of mastering the subject, the student: • to have an idea and knowledge about the concept and basics of digital technologies, the factors of development of the digital economy. • to have the skills to solve problems, model, design features and use them using automated design systems used in educational areas. • the student should have the ability to know the essence of programming, to use it in economic sectors, to accept solutions to the problems of information and communication technologies.

4.	**Educational technologies and methods:** • lectures; • interactive case studies, • seminars (logical thinking, quick questions and answers); • work in groups; • making presentations; • individual rules. • projects for teamwork and protection
5.	**Requirements for obtaining loans:** Full mastery of theoretical and methodological concepts related to science, ability to correctly reflect the results of analysis, independent observation of the studied processes and completion of tasks and tasks given in the current, intermediate control forms, final control test submit.
6.	**Main literature:** 1. Pearson Longman ed English for the Oil Industry Level 2016 2. Oxford English for Careers Oil and Gas 2 Student's Book 2011 3. Абидов А.А. «Генезис нефти и газ и методика поисков их местоскоплеиий- -Тошксит. «Фан». 2010 4. Абидов А.А. Современные основы прогноза и поисков нефти и газа. – Ташкент Фан. 2012 -816с 5. Абидов А.А. «Генезис нефти и газ и методика поисков их местоскоплений-Тошкеиг. «Фан» 2010. 6. Abidov A.A. Dunyo neft va gaz hududlan va akvatonyaiari. Tashkent – Sharq 2009y 7. Abidov A.A., Xolismatov I., Nurmatov M., Abidov X.J., Zakirov S.T. Neft va gaz uymlarini izlash va qidinsh metodlari. Innovatsion rivojlanish nashriyoti. Tashkent 202 Iv. 308 bet **Additional literature:** 8. Mirziyoev Sh. M. Tanqidiy tahlil, qat'iy tartib-intizom va shaxsiy javobgarlik - har bir rahbar faoliyatining kundalik qoidasi bo'lishi kerak O'zbekiston Respublikasi Vazirlar Mahkamasining 2016yil yakunlari va 2017 yil istiqbollariga bag'ishlangan majlisidagi O'zbekiston Respublikasi Prezidentining nutqi. "Xalq so'zi" gazetasi 2017y. 16-yanvar. 9. Pearson Longman ed English for the Oil Industry Level 2016 10. Oxford English for Careers Oil and Gas 2 Student's Book 2011 11. Абидов А.А. «Генезис нефти и газ и методика поисков их местоскоплений-Ташкент. «Фан». 2010г. 12. Абидов А.А. Современные основы прогноза и поисков нефти и газа. – Ташкент Фан. 2012 -816с

	Information sources **www.gov.uz - Government portal of the Republic of Uzbekistan.** **www.lex.uz - National database of information on legal documents of the Republic of Uzbekistan.** **www.wikipedia.ru** **www.geologiya.ru** **www.ziyo.net**