MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION REPUBLIC OF UZBEKISTAN

KARSHI ENGINEERING – ECONOMICS INSTITUTE

Faculty of "Oil and Gas".

"Technological machines and equipment" department

Registered:

№_____

2022 year "___" ____

"APPROVE"

Prorector for educational affairs

R.A.Eshonqulov

"____" _____ 2022 year

"TECHNOLOGICAL EQUIPMENT OF THE OIL AND GAS INDUSTRY

RELIABILITY"

subject

SCIENCE SYLLABUS

Field of knowledge:	300000	- Production is a technical field
The field of education:	320000	- Production technologies
Field of study:	5320300	-Technological machines and equipment (Oil and gas industry machines and equipment)

Karshi-2022

Science (module) code NGSTJI2305	Academic year 2022-2023	Semester 5	ECTcredit 5

The syllabus of the subject was developed in accordance with the sample subject program and the curriculum of the educational field developed by the Karshi Engineering and Economics Institute and approved by the report of the institute's Council No. _____ of 2022.

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The working curriculum of the subject was approved at the meeting of the "Technological Machines and Equipment" department (statement *4*, *07. 10.* 2022), at the Stylistic Commission of the Faculty of "Oil and Gas" (statement *3*, *19. 10* 2022) and at the Stylistic Council of the Institute (statement _____, "_____" _____ 2022) was discussed and recommended for use in the educational process.

Head of the educational and methodological department _____ A.R. Mallayev

Chairman of the Methodological Commission of Faculty _____ B.Yu.Nomozov

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Internet resources
1. www.lex.uz - O'zR Adliya vazirligi sayti.
2. www.bilim.uz - O'zR Oliy va o'rta maxsus ta'lim vazirligi sayti.
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Main literature:

1. Острейковский В.А. Теория надежности: учебник для вузов. – 2-е изд., испр. – М.: Высшая школа, 2008. – 464 с.

2. Кафаров В.В. Анализ и синтез химико-технологических систем. -М.: Химия, 1991. -43 с.

3. Шубин В.С., Рюмин Ю.А. Надёжность оборудования химических и нефтеперерабатывающих производств. - М.: Химия, Колос, 2008. – 359 с.

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3. G'afurov K.X., Shomurodov T.R., Boboyorov R.O. Texnologik mashinalardan foydalanish va ta'mirlash asoslari. –T.: "Sano-standart", 2013.

4. Yuldashev U., Mashinalar ishonchliligi va ta'mirlash asoslari. –T.: 2010. - 320 b.

5. ГОСТ 27.002 – 89 Надежность в технике. Термины и определения.

6. Система технического обслуживания и ремонта оборудования предприятий химической промышленности: Справочник. – М.: Химия, 1983. – 352 с.

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Science (module) type selection	Language of education Uzbek/Rus		Weekly lesson hour 4
	Name of subject	Audience training(hour)	Independent education (hour)	Total (hour)
	Reliability of technological equipment of the oil and gas industry	60	90	150

Information about the teacher

Name of department	Texnological machines and equpments		
Teacher	Name	Telephone number	e-mail
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INTRODUCTION

"Reliability of technological equipment of the oil and gas industry" subject 5320300 - "Technological machinery and equipment (machinery and equipment of the oil and gas industry)" bachelor's education course with the choice of students according to the curriculum of the main educational program is among the studied subjects. The science is based on the initial studies of such subjects as mathematics, physics, chemistry, mechanics, informatics and information technology, thermodynamics, hydraulics and oil and gas technology processes and devices. Basic conditions for mastering science: knowledge of the basic laws of physics and mathematics, ability to solve problems with a certain level of complexity and build models; such as having systematic knowledge formed

in physical definitions in the field of creating and using technological equipment for oil and gas production and processing.

5320300 - "Reliability of technological equipment of the oil and gas industry" is considered one of the main subjects for the undergraduate course "Technological machines and equipment". During the study of science, the reliability of oil and gas technological equipment is considered as a separate object in the system of various technological machines and equipment of the industry.

To acquire the knowledge, skills and theoretical information required by the subject in the educational standard from the teaching of the subject "Reliability of technological equipment of the oil and gas industry" to the profile of the main educational direction, to prepare students for the use of machines and equipment and their organization to introduce reliability indicators of detailers and teach them to calculate these indicators for each machine, mechanism, equipment and detail.

I. MAIN PURPOSE, TASKS AND COMPONENT PARTS OF THE SCIENCE

1.1. The main purpose and tasks of science

The main purpose of science training is to provide in-depth training of specialists for production, design-construction and scientific research activities in the fields of creation and use of technological equipment for oil and gas extraction and processing.

Formation of students' imaginations in the study of science, determination of reliability indicators at the levels of schemes, constructions, calculations, design, effective use and service, diagnostics and repair, as well as quantitative assessment of quality indicators and technical levels of equipment; identifying specific ways to increase reliability; It is carried out by mastering the reliability documents about oil and gas organizations, conducting reliability tests and processing test results, organizing and conducting diagnostics, repair and service. .

The task of science is to provide students with theoretical knowledge and practical skills to ensure reliable performance of oil and gas technological equipment for a long time without damage, to give students individual assignments for independent work, to study science diligently. is to teach winter and study assignment order and analysis.

			program; does not understand the essence of science; if he does not have an idea about science and the subject; if he received unsatisfactory grades from practical training.	
			If the student does not answer IC questions, does not participate in supervision, does not have a positive assessment of practical training and independent work assignments.	0
III. FINAL CONTROL - FC				
STUDENTS WITH A POSITIVE ASSESSMENT FROM THE CURRENT AND INTERMEDIATE CONTROLS ARE INCLUDED IN FINAL CONTROL				
Final conrol if there is a test: For general questions, correct answers are determined and scored based on the number of correct answers				
If it is oral or written:				
3.1.	Final control control of the theoretical part of the subject (oral, test, written)	5	If the student fully completes and explains the FC assignment using his independent theoretical knowledge; makes conclusions and decisions; creative thinking; if he walks in independent observation; can apply knowledge in practice; understands the essence of science; can express; if he tells; if he has an idea about science and the topic.	5
			If the student completes and explains the final control task using independent sources; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express;	4
			If the student completes the FC task with the help of the teacher, if he explains; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express.	3
			Student FC assignment directly from sources if he can't explain it independently. does not master the science program; if he does not understand the essence of science and has no imagination.	2
			If the student does not receive a positive evaluation from the OT, does not attend classes, does not complete and submit the OT assignment.	0

1.4	Completion and submission of independent work assignments	5	If the student fully completes and explains independent work assignments using his independent theoretical knowledge; makes conclusions and decisions; creative thinking; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an idea about science and the topic	5
			If the student completes and explains independent work assignments using independent sources; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an idea about science and the topic	4
			If the student performs independent tasks with the help of the teacher, he explains them; apply the acquired knowledge in practice if; if he understands the essence of science; if he knows; if he tells; if there is imagination in science	3
			If the student performs the independent work assignments directly from the sources, if he cannot explain them; does not master the science program; does not understand the essence of science; if he does not have an idea about science	2
			If the request does not perform and submit independent work	0

II. INTERMEDIATE CONTROL – IC

Students who have been evaluated positively (with 3, 4 or 5 marks) from practical training and independent work assignments will be evaluated from control (oral, test, written) on the theoretical part of the subject. In this case, according to the theoretical part:

In the case of a midterm (ON) test: Correct answers to general questions are determined and scored against the number of correct answers.

IC orally or in writing:

2.1.	Intermediate control control of the theoretical part of the subject (oral, test, written)	5	If the student answers IC questions completely and clearly; makes conclusions and decisions; creative thinking; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an idea about science and the subject; if he received exemplary grades from practical training.	5
			If the student answers IC questions almost completely; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an idea about science and the subject; if he got good grades in practical training.	4
			If the student partially answers IC questions; can apply knowledge in practice; understands the essence of science; can express; if he tells; if he has an idea about science and the subject; if he received satisfactory grades from practical training.	3
			If the student answers IC questions incorrectly, if it is found that it has been copied, does not master the science	2

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The requirements for the knowledge, skills and qualifications of the students are set. Student:

- studies the theoretical laws of the science "reliability of technological equipment of the oil and gas industry";

- enriches theoretical knowledge and practical skills with a process approach in practical activities and acquires the ability to apply them;

- in the construction, repair, reconstruction and restoration of oil and gas wells; in oil and gas production, collection and preparation of well products; increases the ability to service and repair technological equipment used in transportation and storage of hydrocarbon raw materials, oil and gas processing;

- devices create the ability to perform technical work in accordance with technological regulations.

- The student must know the exact ways to increase reliability, have the ability to determine reliability indicators and quantitatively evaluate the quality indicators and technical levels of equipment, organize and conduct reliability tests, process test results to have an idea of providing, diagnosing, repairing and servicing equipment;

- Technological processes in oil gas extraction and processing and the devices, machines, equipment, equipment used for their implementation, and the nodes and elements that make up them are considered as separate objects, ensuring their operation and reliability for a long period of time without breaking down. know how to accept the necessary solutions and be able to use them;

- Collecting, analyzing and processing data on the reliability of student products; should have the skills to draw up reliability-determining and control testing methodology, regulatory and technical documents on reliability management in enterprises.

1.2. The main departments of science and the problems studied in them.

The main departments of the science and the problems studied in them are as follows.

Introduction to science. Basics of reliability theory. Working condition of machines and durability of details. Current state of equipment and future development and improvement. Corrosion, wear and tear of materials.

Basic information about reliability. Continuity. Fault. Ability to work. Stop working. Product features. Working time. Don't quit. Long work. Limit

state. Repairability. Retention. Faultless uptime. A parameter of the flow of failures. Intensity of layoffs.

Classification of dismissals. Accuracy indicators of non-repairable items. Accuracy indicators of repaired items.

Accuracy indicators of repaired items. Frequency of outages. Probability of working without leaving work. Gamma percentage resource. Average uptime to termination.

Determination of accuracy indicators according to test results. Types of information about resignations. Accounting for failures during the warranty period. Accounting for outages after the warranty period.

Factors affecting reliability. Seasonality of layoffs. Verification method. Try for accuracy. Try not to quit. Resource tests. Determining the average resources of associations. Determination of accuracy indicators. Calculation of the optimal alarm replacement period of replaceable parts.

Determining reliability indicators. Calculation of the optimal alarm replacement period of replaceable parts. Calculation of the period of preventive curing.

Calculation of the structure of the repair cycle. Inter-repair period. The inter-Kuric period. Maintenance and repair strategy. Preventive examinations.

Standardization of reliability indicators. Limited service life. Optimal service life. The term of moral obsolescence. Depreciation period. Unregister resource

The influence of accuracy indicators on the economy of machines. Methods of increasing accuracy indicators. Constructive and technological methods of improving the accuracy of machines, methods of ensuring the necessary accuracy in operation.

1.3. Instructions and recommendations on the organization of practical training

Practical training provides students with practical skills and experience in designing the operation of a technological process, which is a component of the reliability of technological machines and equipment, to know its structural elements, to make calculations related to them, to solve examples and problems:

- Fundamentals of analytical apparatus in the theory of reliability;
- Statistical development of information on the reliability of objects;

2.6. Informational and methodological support of the program.

In the process of teaching this subject, modern methods of education, pedagogical and information and communication technologies are used. Including:

- from presentation and electronic didactic technologies with the help of modern computer technologies in lectures related to departments of science;
- from pedagogical technologies of brainstorming and group thinking in practical training sessions on the principles of following the process;
- small group competitions, group thinking pedagogical technologies are used in training.

III. MONITORING THE KNOWLEDGE OF STUDENTS IN SCIENCE

Requirements for obtaining a loan:

Full mastery of theoretical and methodological concepts related to science, ability to correctly reflect the results of analysis, independent observation of the processes being studied, and completion of tasks and tasks given in the current and intermediate control forms, according to the final control pass the test.

Criteria for evaluating students' knowledge based on the rating system

№	Type of control	Maximum rating	Evaluation criteria	Grade
			I. Current control – CC	
1.1	Activeness in practical training	5	If the student fully completes and explains the tasks of practical training using his independent theoretical knowledge; makes conclusions and decisions; creative thinking; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an idea about science and the topic	5
			If the student completes and explains practical training assignments using independent sources; if he walks in independent observation; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an imagination in science	4
			The student will teach the tasks of practical training if he does it with the help of, he explains; can apply the acquired knowledge in practice; if he understands the essence of science; if he knows; can express; if he tells; if he has an imagination in science	3
			If the student performs the practical assignments directly from the sources, if he cannot explain them; does not master the science program; if he does not understand the essence of science, if he does not have an idea about science	2
			If the student does not complete practical training tasks, does not submit them, does not fully participate in training, does not come to supervision	0

2.5. The form and content of organizing independent education

The goal of independent education is to provide students with the knowledge and skills they have acquired in the educational process under the guidance of the teacher, using textbooks, study guides, teaching-methodical sets, Internet information, educational-visual and multimedia materials.

№	Name of themes	hour
1.	The role of technology in ensuring the reliability of machines	2
2.	Operation and reliability of machines	2
3.	Methods of testing machines for accuracy	2
4.	Physical wear and tear of machines	2
5.	The main methods of increasing the reliability and quality of machines	2
6.	Calculation of reliability characteristics of the system in the distribution with the exponential law of disturbances	2
7.	Methods of using calculation formulas, nomograms and graphs	2
8.	The main stages of calculating technological systems	2
9.	Collection of information about reliability of objects	2
10.	Calculation of reliability indicators of simple non-renewable technological systems	2
11	Selection of normalized indicators of reliability for objects of the oil and gas industry	2
12	Collect information on recording equipment breakdowns, malfunctions and fatigue	2
13	The main elements that are important primary scientific and technical design stage of high reliability production	2
14	Basic organizational and technical measures to increase reliability	2
15	Methods of reducing the intensity of damage	2
16	Technical diagnostic tasks	2
17	Ensuring the reliability of machines and equipment	2
18	The efficiency of optimizing the reliability of machines and equipment	2
19	Specifications for the use of large-capacity equipment in the oil and gas industry	2
20	Object groups according to the specificity of the direction of violations	2
21	Types and classification of disorders	2
22	Basic technological measures to increase reliability	2
23	Purpose and methods of technical service	4
	Total:	**48**

- Calculation of reliability characteristics of the system in the distribution of disturbances by the exponential law;

- Calculation formulas using nomograms and graphs, approximate calculation methods using correcting (correcting) coefficients;

- Selection of normalized indicators of reliability for oil and gas production facilities;

- Determining the distribution law of reliability indicators;

- Illuminating the level of reliability indicators;

- Engineer-technological analysis of object damage;

- Reliability indicators of technological systems in slow-gradual breakdowns;

- Reliability indicators of non-renewable technological systems;

During the practical training, the student performs calculations based on the options given on the topic, and it is recommended to use a ruler and colored pencils for making drawings and schemes.

1.4. Connection of science with other sciences and production

In this field of education, it is based on the acquired knowledge of this subject and the philosophical, mathematical and natural (higher mathematics; physics, information technology) planned in the curriculum, general professional (resistance of materials , car details,

thermodynamics, drawing geometry, engineering graphics; applied mechanics; fundamentals of oil and gas work; fundamentals of oil and gas well construction, etc.) is based on knowledge of sciences.

In the process of independent preparation, it is necessary for the student to demonstrate his ability to work with technical literature, Internet materials and normative documents, and to show the ability to correctly observe the information received during the classroom training. Reliability of technological machines and equipment is the basis of the design and production of equipment belonging to each field. That is why the role and importance of this science in production is very large, it is organically connected with production, and the theoretical and practical knowledge that students have acquired in the field of science is used during the period of professional practice strengthen.

1.5. Modern information and pedagogy in teaching science technologies

Innovative pedagogical technologies in science teaching, including the following interactive methods, including discussion-discussion, group discussion or problem-listing, case studies, analysis, discussion or debate, critical thinking, role-playing, small working in groups, brainstorming, cluster (bunch, bundle), fish skeleton, boomerang, scarab, cascade, "T-scheme", blitz question, "What for?" technologies, lecture-conference techniques, conceptual and insert tables are widely used.

Also, it is envisaged to use electronic lectures, multimedia slides and video films suitable for the topics during lectures.

II. -" DISTRIBUTION OF COURSES BY SUBJECTS AND HOURS ON THE RELIABILITY OF TECHNOLOGICAL EQUIPMENT IN THE OIL AND GAS INDUSTRY

" "Reliability of technological equipment of the oil and gas industry" is studied in the 5th semester of the academic year. Table 1 shows the distribution of academic sessions by semester.

1 – table

The distribution of training sessions in science and the time allocated for them

Academic semester	Content of classes					Total, hour
	Lecture, hour	Practical training, hour	Laboratory work, hour	Independent work, hour	Independent assignment	
V	30	30	-	90		150

Table 2 shows the distribution of subject subjects by types and hours of classes..

2 – table

2.2. - Calendar plan of practical training on "Reliability of technological equipment of the oil and gas industry".

№	Name of practical trainings	hour
1	Fundamentals of analytical apparatus in the theory of reliability.	2
2	Statistical information about the reliability of objects development.	2
3	Statistical information about the reliability of objects development	2
4	In the distribution of disturbances with the exponential law calculation of reliability characteristics of the system.	2
5	In the distribution of disturbances with the exponential law calculation of reliability characteristics of the system.	2
6	Calculation formulas are estimated using nomograms and graphs, using correcting (correcting) coefficients. calculation methods.	2
7	Calculation formulas are estimated using nomograms and graphs, using correcting (correcting) coefficients. calculation methods.	2
8	Reliability for oil and gas production facilities selection of normalized indicators.	2
9	Reliability for oil and gas production facilities selection of normalized indicators.	2
10	Determining the distribution law of reliability indicators.	2
11	Clarifying the level of reliability indicators.	2
12	Engineer's technological analysis of object damage.	2
13	Engineer's technological analysis of object damage.	2
14	Reliability of technological systems in slow - gradual breakdowns indicators.	2
15	Reliability of simple non-renewable technological systems indicators.	2
Total:		30

2.3. Instructions and recommendations on the organization of laboratory training
The curriculum does not include laboratory training.
2.4. Instructions and recommendations on course work (project).
The coursework (project) is not provided for in the curriculum.

2.1. - The calendar plan of the lecture on "Reliability of technological equipment of the oil and gas industry".

T/r	Name of theme	Hour
1.	Entroduction. Basics of reliability theory	2 hour
2.	Basics of reliability theory	2 hour
3.	Basic information about reliability	2 hour
4.	Basic information about reliability	2 hour
5.	Basic information about reliability	2 hour
6.	Classification of dismissals	2 hour
7.	Classification of dismissals	2 hour
8.	Classification of dismissals	2 hour
9.	Accuracy indicators of repaired items	2 hour
10.	Accuracy indicators according to test results determination	2 hour
11.	Factors affecting reliability.	2 hour
12.	Determining reliability indicators.	2 hour
13.	Calculation of the structure of the repair cycle.	2 hour
14.	Standardization of reliability indicators	2 hour
15	The influence of accuracy indicators on the economy of machines	2 hour
	Total	**30 hour**

№	Theme	Lecture	Laboratory work	Practical training	Independent work
1.	**Introduction. Basics of reliability theory.** Foundations of the theory of thoroughness. Working condition of machines and durability of details	2			6
2.	**Basics of reliability theory.** Current state of equipment and future development and improvement. Corrosion, wear and tear of materials.	2			6
3.	**Basic information about reliability.** Basic information about accuracy. Continuity. Fault. Ability to work. Stop working. Product features. Operating time (input).	2			6
4.	**Basic information about reliability.** Basic information about accuracy. Continuity. Fault. Ability to work. Stop working. Product features. Operating time (input).	2			6
5.	**Basic information about reliability.** Retention. Faultless uptime. A parameter of the flow of failures. Intensity of layoffs. Resource. Gamma percentile resource	2			6
6.	**Classification of dismissals** Classification of dismissals. To work dropouts. Random outages. Losses due to eating.	2			6
7.	**Classification of dismissals** Random outages. Losses due to eating.	2			6
8.	**Classification of dismissals** Accuracy indicators of repaired items. of the discharge current parameter. Readiness coefficient	2			6

9.	**Accuracy indicators of repaired items.** Accuracy indicators of repaired items. Frequency of outages. Probability of working without leaving work. Gamma percentage resource. Average working time until exit	2			6
10	**Determination of accuracy indicators according to test results.** Determination of accuracy indicators according to test results. Types of information (information) about resignations. Special tests. Making complaints during the warranty period. Taking into account failures after the warranty period. Accounting for failures during the warranty period.	2			6
11	**Factors affecting reliability.** Seasonality of layoffs. Verification method. Try for accuracy. Data for calculating accuracy indicators. Active experiment. Passive experiment. Try not to quit. Resource tests. Determining the average resources of associations.	2			6
12.	**Determining reliability indicators.** Determining reliability indicators. Calculation of the optimal alarm replacement period of replaceable parts. Calculation of the period of preventive curing	2			6
13.	**Calculation of the structure of the repair cycle.** Calculation of the structure of the repair cycle. Inter-repair period. The intertrial period. Technical service and repair strategy. Preventive examinations.	2			6
14.	**Standardization of reliability indicators.** Standardization of accuracy indicators. Limited service life. Optimal service life. The term of moral obsolescence. Depreciation period. Deregistration resource	2			6
15.	**The influence of accuracy indicators on the economy of machines.** The influence of accuracy indicators on the economy of machines. Methods of increasing accuracy indicators. Constructive and technological methods of improving the accuracy of machines. due diligence in operation methods of provision	2			6
	Total	30			90