NJSC «Kazakh national research technical university named after K.I. Satpayev»

K. Turysov Institute of Geology, Oil and Mining

Petroleum Engineering Department

EDUCATIONAL PROGRAM

Bachelor of engineering and technology in the educational program6B07204 - «Petroleum engineering»

2nd edition in accordance with the 2018 State Mandatory

Educational Standards for Higher Education

Almaty 2022

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

The education program was developed by the faculty of the Department of Petroleum engineering

PE Department Head Yeligbayeva G.
agreed:
Director of G&OGB Institute Syzdykov A.

From employers:
1. Askar Munara, Managing Director for Field Planning, KazMunayGas Research Institute of Production and Drilling Technologies LLP,
2. Beibit Jumanov, Completion Engineer Weatherford.

From the academic partner:
1. Erdal Ozhan, Head of the Department of Petroleum Engineering, Colorado School of Mines, Chairman of the Industry Advisory Board of the Petroleum Engineering Program.

Approved at a meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K.Satpayev. Minutes No 3 dated 25 June, 2021

Qualification:
Level 6 of the National Qualifications Framework:
6B07 Engineering, manufacturing and construction industries
6B072 Manufacturing and processing industries (bachelor)

Professional competence: Organization and management of processing and technologies of drilling oil and gas wells, field development, production and transportation of oil and gas.

CONTENT

BRIEF DESCRIPTION OF THE PROGRAM

The aim of developing an educational program (EP)

The educational program (hereinafter, EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satbayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan. The EP takes into account the needs of the regional labor market, the requirements of state bodies and the corresponding industry requirements and is based on the state educational standard for higher professional education in the relevant field.

The EP defines the programmatic educational goals, learning outcomes of students, the necessary conditions, content, and technologies for the implementation of the educational process, assessment, and analysis of the quality of students during study and after graduation.

EP includes the curriculum, content of the course and learning outcomes, and other resources to provide quality education for students.

The purpose of the EP Petroleum Engineering is to help students, faculty and industry experts understand the structure of the educational process and demonstrate how the curriculum and course content contribute to the formation of the necessary core competencies after graduation by students. Last but not least, the EP's goal is to establish a common framework for the feasibility and necessity of a Petroleum Engineering training program for all stakeholders, including government, government agencies, the oil and gas industry, universities, parents and students, and the community.

Regulatory documents used to develop this educational program

Legal framework and recommended methods used for the development of EP "Petroleum Engineering":

- Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III "On Education";
- Decree of the Government of the Republic of Kazakhstan dated August 23, 2012 No. 1080 "On approval of state compulsory education standards of the corresponding levels of education";
- Decree of the Government of the Republic of Kazakhstan dated May 17, 2013 No. 499 "On approval of the Model Rules for the Activities of Educational Organizations of the appropriate types, including the Model Rules for Educational Organizations Implementing Additional Educational Programs for Children" (as amended on April 7, 2017);
- State compulsory education standard SES 03.08.334.-2006 in specialty 050708 - "Petroleum Engineering";
- Other regulatory and methodological documents of the Ministry of Education and Science of the Republic of Kazakhstan;

- Industry qualifications framework for oil and gas, oil refining and petrochemical industries, Astana, 2017, http://www.kazenergy.com/upload/document/industry-frame/ork.pdf (last accessed December 10, 2018);
- Methodological recommendations for the development and execution of sectoral qualifications frameworks, Astana, 2016, http://atameken.kz/uploads/content/files/Methodology% 20% 20ОРК% 202016.pdf (last accessed December 10, 2018);
- The working curriculum for the specialty "Petroleum Engineering", approved by the Rector of the Kazakh National Research Technical University named after K.I. Satbayev;
- Documents of the TQM (Total Quality Management) system on the organization of the educational process at the Kazakh National Research Technical University named after K.I. Satbayev;
- SPE (Society of Petroleum Engineers) Petroleum Engineering Sample Curriculum, https://www.spe.org/members/docs/Model-Petroleum-Engineering-Curriculum.pdf (last accessed December 10, 2018);
- The SPE Technical Knowledge for Graduating Engineers Matrix, http://www.spe.org/training/docs/graduating_matrix.pdf (last accessed December 10, 2018);
- SPE Competency Matrices, https://www.spe.org/training/competency.php (last accessed December 10, 2018);
- ABET Accreditation Criteria and Supporting Documents, http://www.abet.org/accreditation/accreditation-criteria/

General information for the development of an educational program

As shown in Figure 1, the provisions defining a quality EP start with clear and concise Program Educational Objectives, (hereinafter PEO), which are closely related to the mission of the program.

In addition, the PEO determines the expected knowledge and skills of students upon graduation.

EP "Petroleum Engineering" in the formation of knowledge and skills of students after graduation was based on Criterion 3 ABET (Accreditation Board for Engineering and Technology) – Student Outcomes, since among engineering courses, ABET accreditation is considered prestigious and highly recommended.

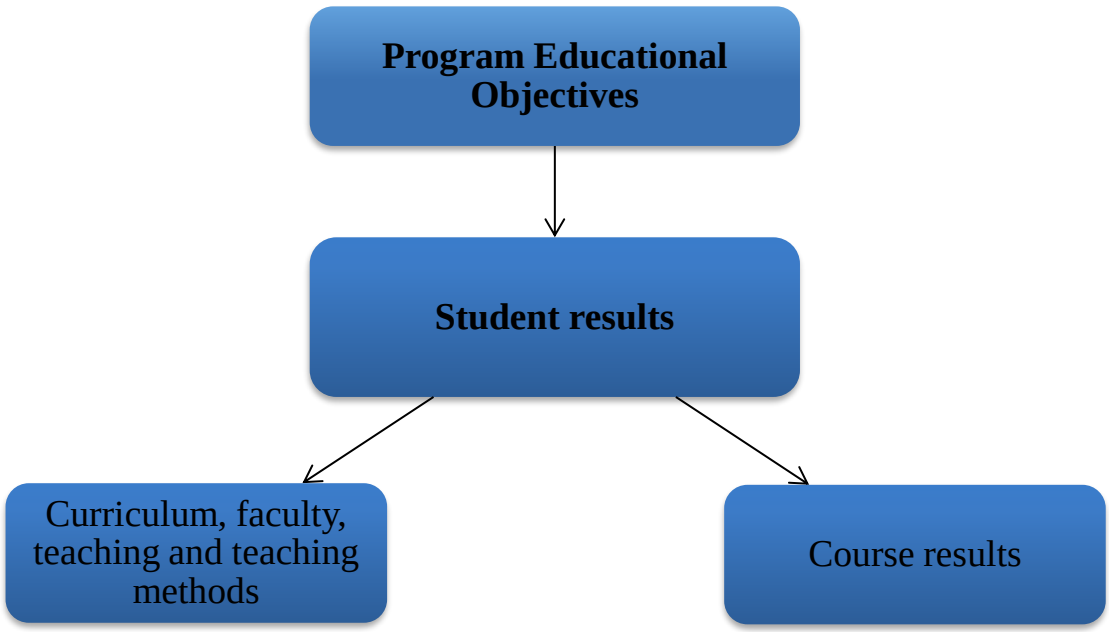

Figure 1 - The relationship of different components in the definition of the educational program

Professional and labor activities

An area of professional activity or a ***professional group*** is a set of types of labor activity in an industry that has a common integration basis (analagous or similar purpose, objects, technologies, including labor tools) and assumes a similar set of labor functions and competencies for their implementation.

The type of labor activity or ***professional subgroup*** is a part of a professional group, a set of professions, formed by an integral set of labor functions and the competencies necessary for their implementation.

Table. 1 shows 5 main areas of professional activity and 21 types of labor activity for graduates of EP "Petroleum Engineering", according to the sectoral framework of qualifications (hereinafter SFQ). It should be noted that during the process of developing the EP "Petroleum Engineering", the experience of the world oil and gas industry was taken into account in the classification of the main areas of professional activity. For example, the current classification of the SFQ misses the direction "Development of Oil and Gas Fields" - physical and chemical methods, mechanisms, and processes occurring in the reservoir and a qualitative description of these phenomena. Therefore, EP "Petroleum Engineering" includes the best world practices of the oil and gas industry, while at the same time building on the existing historical traditions.

Table 1 - Areas of professional and work activities in the oil and gas industry, according to the SFQ (6-level: bachelor's degree)

Professional group	**Professional subgroup**
Exploration for Oil and Gas	Geological and geophysical works for oil and gas exploration
Drilling Oil and Gas Wells	Drilling management
Oil and Gas Production	Manufacturing control
	Maintenance and repair of special machinery and field equipment
	Exploitation of Oil and Gas Wells
	Maintaining Reservoir Pressure
	Well Servicing
	Well-workover operation
	Oil and Gas processing and pumping
	Well surveying
Oil transportation	Manufacturing control
	Operation of main oil pipelines
	Oil transportation services
	Operation of the process equipment
	Diagnostics of technological equipment and linear part of main oil pipelines
	Maintenance of electrochemical protection equipment
Gas transportation	Manufacturing control
	Operation and repair of horizontal steel tank (HST), gas facilities
	Operation and repair of the linear part of the main gas pipeline
	Operation and repair of compressor stations
	Commodity- transport operations of the main gas pipeline

Contact infromation

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ACADEMIC REQUIREMENTS

Admission requirements

Admission to a university is carried out according to the applications of an applicant who completed secondary, secondary- professional education in full on a competitive basis in accordance with the points of the certificate issued based on the results of a single national test with a minimum score of at least 65 points, including at least 5 points - in the History of Kazakhstan, quantitative literacy, reading literacy - the language of study, and at least 5 points in each profile subject.

Special requirements for admission to the program apply to graduates of 12-year schools, colleges, applied bachelor's programs, NIS, etc. These applicants must pass diagnostic testing in English, mathematics, physics, and special disciplines.

Table 2 - Rules for credit transfer for accelerated education based on 12-year secondary, secondary- technical and higher education

Code	Competency type	Description of competence	Competence Result	In Change
GENERAL (It implies full training with possible additional, depending on the level of knowledge)				
G1	Communicativeness	- fluent monolingual speaking, writing and communication skills - the ability to not fluently communicate with a second language - ability to use communicative capability in various situations - there are the basics of academic writing in the native language - diagnostic test for language level	Full 4-year study with a minimum of 240 academic credits (of which 120 contact classroom academic credits) with a possible transfer of credits in a second language, where students have an advanced level. The level of the language is determined by passing a diagnostic test	Department of Kazakh and Russian Languages, Department of English Language
G2	Quantitative Literacy	- Basic mathematical thinking at the communication level - the ability to solve situational problems based on the mathematical	Full 4-year study with a minimum of 240 academic credits (of which 120 contact classroom academic credits).	Department of Math

		apparatus of algebra and the beginnings of mathematical analysis - diagnostic test for mathematical literacy in algebra	With a positive passing of the diagnostic test, the level of Mathematics is 1, with a negative - the level of Algebra and the beginning of the analysis	
G3	Basic literacy in science disciplines	- basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science - understanding of basic hypotheses, laws, methods, formulation of conclusions and estimation of errors	Full 4-year study with a minimum of 240 academic credits (of which 120 contact classroom academic credits). With a positive passing of the diagnostic test, the level of Physics 1, General Chemistry, with a negative - the level of the Beginning of Physics and Basic Foundations of Chemistry	Natural Sciences Departments
SPEFICIC (implies reduced training through credit transfer depending on the level of knowledge in competencies for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas)				
S1	Communicativeness	- Fluent bilingual oral, written and communication skills - ability to communicate fluently with a third language - skills of writing text of different style and genre - skills of deep understanding and interpretation of one's own work of a certain level of complexity (essay)	Full credit transfer by language (Kazakh and Russian)	Department of Kazakh and Russian languages

		- basic aesthetic and theoretical literacy as a condition for full-fledged perception, interpretation of the original text		
S2	Quantitative Literacy	- Special mathematical thinking using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction, and analogy - the ability to formulate, substantiate and prove assumptions - application of general mathematical concepts, formulas and extended spatial perception for mathematical problems - a complete understanding of the basics of mathematical analysis	Credit transfer in the discipline Mathematics (Calculus) I	Department of Math
S3	Special literacy in natural sciences (Physics, Chemistry, Biology and Geography)	- Broad scientific perception of the world, offering a deep understanding of natural phenomena - critical perception for understanding scientific phenomena of the surrounding world - cognitive ability to formulate a scientific understanding of the forms of existence of matter, its interaction,	Credit transfer for Physics I, General Chemistry, General Biology, Introduction to Geology, Introduction to Geodesy; Study practice, etc.	Natural Sciences Departments

		and manifestations in nature		
S4	English Language	- readiness for further self-study in English in various fields of knowledge - willingness to gain experience in design and research work using English	Transfer of English credits above academic to professional level (up to 15 credits)	Department of English Language
S5	Computer skills	- Basic programming skills in one modern language - use of software and applications for training in various disciplines - existence of a global standard of language level certificate	Transfer of credits for the discipline Introduction to Information and Communication Technologies, Information and Communication Technologies	Department of Software Engineering
S6	Social and humanitarian competences and behavior	- understanding and awareness of the responsibility of each citizen for the development of the country and the world - Ability to discuss ethical and moral aspects in society, culture, and science	Credit Transfer for Modern History of Kazakhstan (except for state exam)	Department of Social Disciplines
		- Critical understanding and ability for polemics for debating on contemporary scientific hypotheses and theories	Recalculation of credits in philosophy and other humanitarian disciplines	
PROFESSIONAL (implies reduced training through credit transfer, depending on the level of knowledge in competencies for graduates of colleges, private schools, universities, including humanitarian and economic areas)				
P1	Professional competence	- critical perception and deep understanding of professional	Transfer of credits in basic professional disciplines, including an	Petroleum Engineering Department

		competencies at level 5 or 6 - Ability to discuss and argue on professional issues within the framework of the mastered program	introduction to the specialty, the structure and design of systems and machines by industry, after-sales service of machines by industry, educational and training practice	
P2	General engineering competencies	- basic general engineering skills and knowledge, the ability to solve general engineering problems and problems - be able to use software packages for processing experimental data, solving systems of algebraic and differential equations	Credit transfer for general engineering disciplines (Engineering graphics, descriptive geometry, fundamentals of mechanics, fundamentals of hydrodynamics, fundamentals of electrical engineering, fundamentals of microelectronics, fundamentals of thermodynamics, fundamentals of geology, etc.)	Petroleum Engineering Department
P3	Computer engineering competence	- basic skills of using computer programs and soft systems for solving general engineering problems	Credit transfer for the following computer graphics disciplines, CAD fundamentals, CAE fundamentals, etc.	Petroleum Engineering Department
P4	Engineering and working competencies	- skills and abilities to use technical means and experimental devices for solving general engineering problems	Transfer of credits for academic disciplines of the experimental direction: turning and locksmithing, repair work, welding, laboratory or analytical chemistry,	Petroleum Engineering Department

			laboratory physics, mineralogy, etc.	
P5	Socio-economic competencies	- Critical understanding and cognitive reasoning ability on contemporary social and economic issues - Basic understanding of the economic assessment of objects of study and the profitability of industry projects	Recalculation of credits in socio-humanitarian and technical and economic disciplines in the offset of the elective cycle	Petroleum Engineering Department

The university may refuse to transfer credits if a low diagnostic level is confirmed or the final grades in completed disciplines were below A and B.

Requirements for completion EP and graduating

Description of the generally obligatory standard requirements for graduating from a university and assigning an academic bachelor's degree: completing at least 240 academic credits of theoretical study and a final capstone project or a state exam, according to the specialty.

The form of education: Full-Time

The length of study: from 4 to 7 years.

The language of study: Kazakh, Russian, English (more than 50%)

Additional Minor degree policy

During the competing of at least 18 credits in the disciplines of the program, including the following compulsory subjects:

M1 – Drilling oil and gas wells (PET101);

M2 – Rock Properties (PET176);

M3 – Reservoir Fluid Properties (PET129);

M4 – Reservoir Engineering I. Primary Production (PET124);

M5 – Oil Production (PET134);

M6 – Petroleum Facility Design (PET169);

An additional specialty “Minor” is assigned with the issuance of a diploma supplement of the established form.

ECTS Diploma Supplement

The European Diploma Supplement (hereinafter - the European Supplement), or the Diploma Supplement (DS), is, along with ECTS (European Credit Transfer System), an effective tool for ensuring academic and professional mobility in the European Higher Education Area.

The aim of the DS is to provide comprehensive independent data in order to ensure international "transparency" and objective academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.).

Requirements:

1. The European Diploma Supplement is issued by the Kazakh National Research Technical University named after K.I.Satbayev to graduates of accredited educational programs only in strict accordance with the model developed by the Joint Working Group of representatives of the European Commission, Council of Europe, and UNESCO.

2. The European Diploma Supplement does not contain any judgments of the assessment plan, comparisons with other study programs and recommendations regarding the possibility of recognition of this diploma or qualification.

3. The European Diploma Supplement consists of eight sections and must contain information on all sections. In the absence of information in any of the sections of the European Diploma Supplement, it is necessary to indicate the reasons for refusing to provide mandatory information.

4. The European Diploma Supplement must always accompany the original document of education, as it has no legal force. The presence of the European Diploma Supplement does not guarantee the status of an educational institution, its qualifications, or the fact that it is recognized as an integral part of the national higher education system.

5. Each European Diploma Supplement must begin with a preamble:

“This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO / CEPES. The purpose of the Supplement is to provide comprehensive independent data in order to ensure international "transparency" and objective academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.). The application contains a description of the nature, level and status of training passed and successfully completed by the person named in the original qualification document. Judgments, statements of equivalence, or proposals for recognition are not permitted in the Appendix. Data should be reported for all eight sections. In the absence of such data, the reason must be indicated. "

6. The European Diploma Supplement must always contain the title and the degree of qualification; name and status of the awarding / managing institution and the classification of the qualifications. All these data must be presented in official and English languages, since an incorrect translation misleads those who make judgments about

qualifications. In cases where an alphabet other than Latin is used, transliteration is permitted. You can link the titles of degrees and qualifications to the description of the higher education system in the eighth section.

7. Educational institutions should take appropriate measures to reduce to a minimum the possibilities of fraud and misrepresentation of the European Diploma Supplements.

8. Special attention should be paid to translation and terminology. To overcome the problems arising in this area, it is essential that the original language is used where indicated in the document.

9. In the European Diploma Supplement, the assessment of qualifications obtained in other countries should focus on the knowledge, skills and abilities acquired, taking into account the fact that it is not exact equivalence but “fair recognition” that should be sought.

The diploma supplement consists of 8 mandatory items and is issued in English and Kazakh / Russian languages.

1. Information identifying the holder of the qualification
2. Information identifying the qualification
3. Information on the level of the qualification
4. Information on the contents and results gained
5. Information on the function of the qualification
6. Additional information
7. Certification of the supplement
8. Information on the national higher education system

«PETROLEUM ENGINEERING» EP's WORKING CURRICULUM

Year of study	Code	Name of discipline	Cycle	Total amount in loans	lec/lab/pr	SRS (including SRSP), in hours	pre-requisites	Year of study	Code	Name of discipline	Cycle	Total amount in loans	lec/lab/pr	SRS (including SRSP), in hours
1	**1st semester (Fall 2021)**								**2nd semester ((Spring 2022)**					
	LNG108	English	G	5	0/0/3	105	Diagnostic test		LNG108	English	G	5	0/0/3	105	yes
	LNG104	Kazakh (Russian) language	G	5	0/0/3	105	Diagnostic test		LNG104	Kazakh (Russian) language	G	5	0/0/3	105	yes
	PET103	Introduction to Major	G	5	1/0/2	105	no		HUM100	Contemporary history of Kazakhstan	G	5	1/0/2	105	yes
	PHY111	Physics I	B	5	1/1/1	105	no		PHY464	Electromagnetism.Optics.	B	5	1/1/1	105	PHY111
	MAT101	Mathematics I	B	5	1/0/2	105	no		MAT102	Mathematics II	B	5	1/0/2	105	MAT101
	CEN177	Engineering and computer graphics	B	5	1/0/2	105	no		HUM128	Political science	G	2	1/0/0	45	no
	HUM129	Culturology	G	2	1/0/0	45	no		CHEE495	Chemistry	B	5	1/1/1	105	no
	KF101	Physical training I	G	2	0/0/2	30	no		KF102	Physical training II	G	2	0/0/2	30	KF101
	Total:			**34**					**Total:**			**34**			
2	**3th semester (Fall 2022)**								**4th semester (Spring 2023)**					
	HUM132	Philosophy	G	5	1/0/2	105	no		CSE677	Information and Communication Technologies (eng)	G	5	2/1/0	105	no
	CHE451	Life safety	G	2	1/0/0	45	no		HUM127	Sociology	G	2	1/0/0	45	no
	MAT103	Mathematics III	B	5	1/0/2	105	MAT 102		CHE452	Ecology and sustainable development	G	2	1/0/0	45	no
	HUM122	Psychology	G	2	1/0/0	45	no		PET411	Reservoir rock properties	B	5	2/1/0	105	no
	MNG487	Fundamentals of Entrepreneurship, Leadership, and anti-corruption culture	G	3	1/0/1	60	no		PET409	Thermodynamics and heat engineering	B	5	1/0/2	105	PHY112
	GEN408	Strength of materials	B	5	1/1/1	`105	PHY 112		PET410	Fluid mechanics	B	5	1/1/1	105	no
	CHE559	Chemistry of oil and gas	B	5	2/1/0	105	CHE 192		GEO487	Geology and mineral resources of Kazakhstan	B	5	2/1/0	105	no
	PET408	Solving the problems of oil and gas engineering	B	5	1/0/2	105	no		KFK104	Physical training IV	G	2	0/0/2	30	AAP122
	KFK103	Physical training III	G	2	0/0/2	30	KFK 102								
	Total:			**34**					**Total:**			**31**			
3	**5th semester (Fall 2023)**								**6th semester (Spring 2024)**					
	PET412	Oil and gas well drilling	B	5	2/1/0	105	no		PET422	Revervoir engineering II: Secondary and tertiary recovery	B	5	1/0/2	105	PET412
	PET415	Revervoir fluid propeties	B	5	2/1/0	105	PET410		PET424	Well log analysis	B	5	2/1/0	105	PET176
	PET416	Revervoir engineering I: Primary recovery	B	5	1/0/2	105	no		PET426	Well completion	S	5	2/0/1	105	PET101
	PET418	Petroleum Engineering seminar	B	5	2/1/0	105	no		PET425	Petroleum Production Engineering	S	5	1/1/1	105	PET103
		ELECTIVE	S	5		105	no		PET455	Fundamentals of Data Analytics and Programming for Petroleum Engineers	B	5	1/1/1	150	no
	Total:			**25**					**Total:**			**25**			
4	**7th semester (Fall 2024)**								**8th trimester ((Spring 2025)**						

		ELECTIVE	S	5		105	no
		ELECTIVE	S	5		105	no
		ELECTIVE	S	5		105	**no**
	PET111	Economic evaluation of oil and gas projects	S	5	1/0/2	105	no
	PET169	Oil and gas facilities design and operation	S	5	1/0/2	105	PET134
	Total:			**25**			

ECA003	Preparation for diploma project	FA	6			
ECA103	Diploma project defense	FA	6			
PET441	Multidisciplinary petroleum project	S	5	2/1/0	105	no
	ELECTIVE	S	5		105	no
Total:			**22**			

Year of study	Code	Name of discipline	Cycle	Credits	Semester
Obligatory academic elements with P/NP assessment					
1	AAP101	Study internship (B)	B	2	2
2	AAP141	Industrial Internship I (П)	B	4	4
3	AAP176	Industrial Internship II (П)	S	5	6
Additional academic elements					
1	AAP107	Sectional sports club	G	0	5-7
2-3	AAP500	Military training	G	0	3-6

Total number of credits			
Cycle of disciplines	**Credits**		
	compul-sary	**additional**	**total**
Cycle of general disciplines (G)	58	0	58
Cycle of basic disciplines (B)	112	0	112
Cycle of special disciplines (S)	60	0	60
Total of theoretical study :	230	0	**230**
Final attestation (FA)	12	0	**12**
Total:	242	0	**242**

«PETROLEUM ENGINEERING» EP's MAJOR ELECTIVE DISCIPLINES

year of study	Elective code	Code	Name of course	Component	credit	lec/ lab/pr	Prerequisites
	5th semester						
3	3338	PET417	Petroleum regulations and practices	S	5	2/0/1	no
		PET114	Drilling solutions			2/0/1	PET112
		PET420	Natural gas engineering			2/0/1	PET133
		PET427	Design and operation of oil and gfs pipelines			1/0/2	no
	Total:				**5**		
4	**7th semester**						
	4344	PET437	Well stimulation	S	5	2/0/1	PET124
		PET433	Flow assurance			1/0/2	PET124
		PET431	Revervoir engineering III: reservoir simulation			2/0/1	PET125
	4345	PET432	Directional drilling	S	5	2/0/1	PET101
		PET434	Design and operation of oil and gas storages			1/0/2	PET 172
		PET439	Artificial lift systems			1/1/1	PET125
	4346	PET442	Well testing	S	5	2/1/0	PET133
		PET440	Well workover			2/0/1	PET101
		PET430	Computer - aided design			2/0/1	AUT109
	Total:				**15**		
	8th semester						
	4352	PET438	Development of offshore fields	**S**	**5**	1/0/2	PET134
		PET419	Corrosion protection of oil abd gas equipment			2/0/1	no
		PET421	Reservoir geomechanics			2/0/1	PET101

		PET423	Geostatistica			2/0/1	no
		PET428	Design and operation of pump and compressor stations			1/0/2	no
		PET429	Multiphase flow systems			1/0/2	PET124
		Total:			**5**		

Credits numbers of elective disciplines over the entire period of study	
Cycle of disciplines	**credits**
Cycle of general disciplines (G)	0
Cycle of basic disciplines (B)	0
Cycle of special disciplines (S)	25
Total:	**25**

Kazakh National Research Technical University (Satbayev University)
"Petroleum Engineering" undergraduate curriculum flowchart of 2020
In a case of discrepancy of this flowchart with the approved curriculum, the curriculum is the main document.

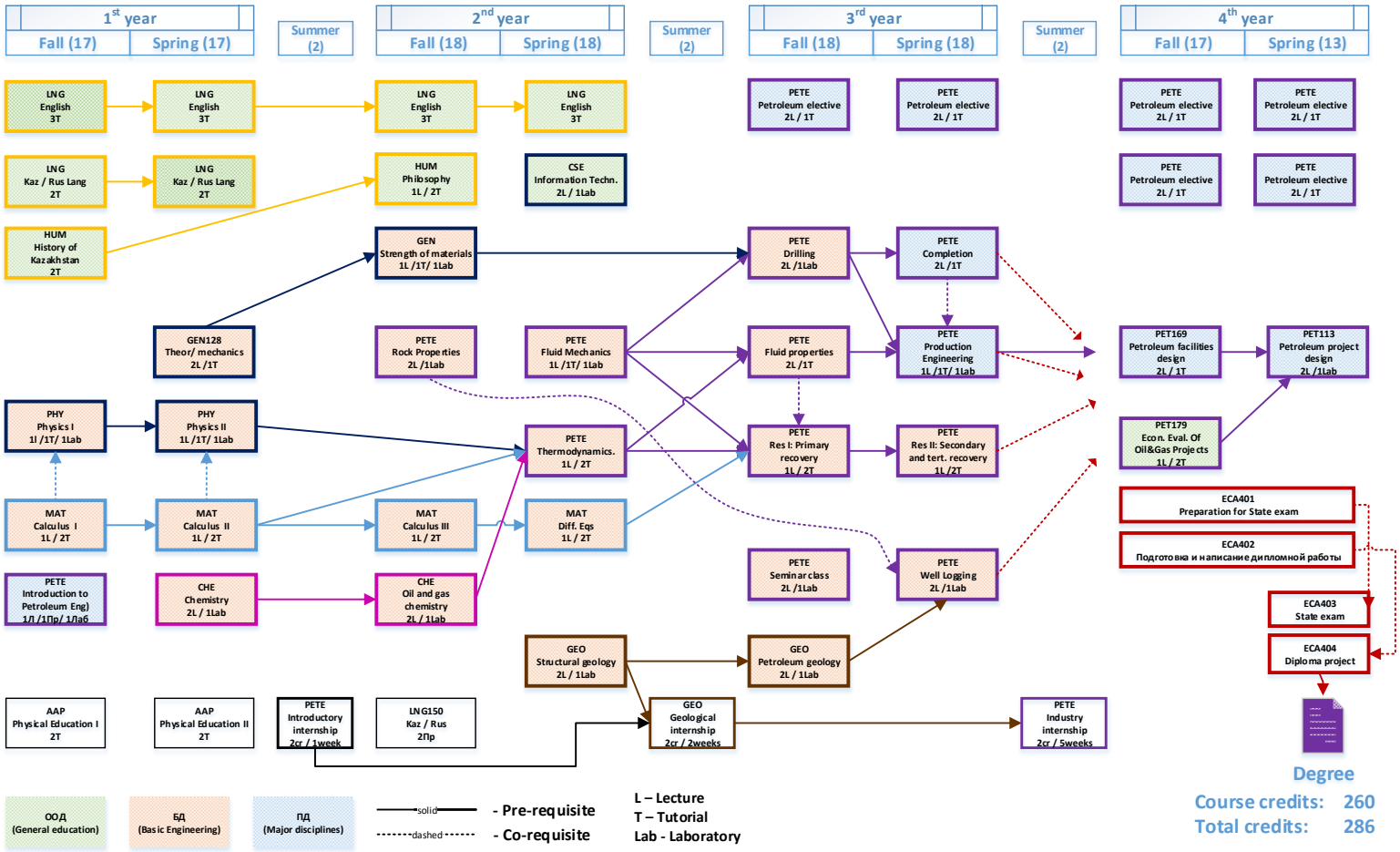

Figure 2 – Flowchart of the working curriculum

Kazakh National Research Technical University (Satbayev University)
Petroleum Engineering Elective Disciplines (of 2020)

The list of electives	
Fall	**Spring**
Oil property, lease and regulations (All specialties)	Reservoir geomechanics (Drilling, Production)
Drilling fluids (Drilling)	Geostatistics (Reservoir)
Oilfield equipment corrosion protection (Production, Midstream)	Oilfield equipment (Production, Midstream)
Natural gas engineering (Reservoir, Production)	Multiphase flow systems (Production, Midstream)
Oil and gas pipeline design and operation (Midstream)	Pump and compressor stations design and operation (Midstream)

3rd-year*

4th-year**
Well stimulation (Drilling, Reservoir, Production)
Artificial lift systems (Production)
Flow assurance (Production, Midstream)
Reservoir engineering III: Reservoir simulation (Reservoir)
Directional drilling (Drilling)
Offshore field development (Reservoir, Production, Midstream)
Well testing (Reservoir, Production)
Oil and gas storage design and operation (Midstream)
Well workover (Drilling, Production)
Computer-aided design (Production, Midstream)

Notice:
* - 3rd-year electives can be selected both in fall and spring semesters, and also in the 4th-year, but ***in the obligatory condition of minimum 10 students is met.***
** - 4th-year elective disciplines can be selected only after passing the 3rd-year core disciplines (again, ***not less than 10 students must be in the class***).

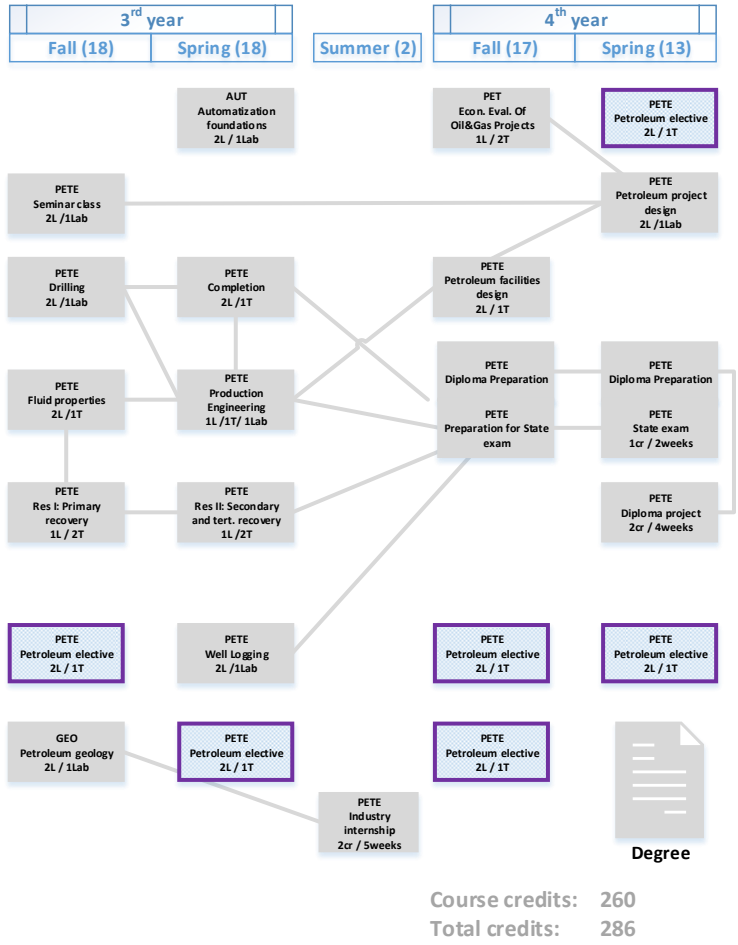

Figure 3 – Major elective disciplines of the educational program «Petroleum Engineering»

PETROLEUM ENGINEERING EDUCATIONAL PROGRAM's OBJECTIVES

1. Our graduates will be able to apply knowledge of mathematics, science and technology, as well as identify, formulate and solve engineering problems to improve the technological processes of the oil and gas industry.
2. Our graduates will be able to effectively convey information and thoughts to other people.
3. Our graduates will practice ethical, social, and environmental standards in their professions in a responsible manner.
4. Our graduates will exhibit a high level of competence in engineering principles and practice.
5. Our graduates will be able to work in diverse industry and multicultural teams.
6. Our graduates will serve society, the oil and gas industry, the country through participation in professional communities and public organizations.
7. Our graduates will be successful professionals, ready to lead a team, organization, the Republic of Kazakhstan and the world community to new achievements.

Table 3 – Relationship matrix of Student Outcomes and Educational Program Objectives

Student Outcomes (Descriptors of knowledge, skills and competencies)		EPO 1. Apply knowledge of mathematics, science and technology, as well as identify, formulate and solve engineering problems to improve the technological processes of the oil and gas industry.	EPO 2. Effectively convey information and thoughts to other people.	EPO 3. Practice ethical, social, and environmental standards in their professions in a responsible manner.	EPO 4. Exhibit a high level of competence in engineering principles and practice.	EPO 5. Be able to work in diverse industry and multicultural teams.	EPO 6. Serve society, the oil and gas industry, the country through participation in professional communities and public organizations.	EPO 7. Be successful professionals, ready to lead a team, organization, the Republic of Kazakhstan and the world community to new achievements.
(a)	apply knowledge of mathematics, science and technology	✓			✓			✓
(b)	design and conduct experiments, and analyze and interpret data	✓			✓			
(c)	design a system, component or process to meet the desired	✓		✓	✓			

	needs within realistic constraints							
(d)	work in interdisciplinary teams		✓			✓	✓	
(e)	identify, formulate and solve technical problems	✓		✓				
(f)	understand professional and ethical responsibilities			✓	✓		✓	✓
(g)	communicate effectively		✓		✓	✓	✓	✓
(h)	understand the impact of technical solutions in a global, economic, environmental and social context			✓			✓	✓
(i)	recognize the need for lifelong learning and self-learning				✓			
(j)	know modern problems			✓	✓		✓	
(k)	use the techniques, skills and modern engineering tools required for engineering practice	✓			✓			

Table 3 shows the relationship between student outcomes and the reported EPO. The recommended way to interpret this table is to put before the EPO the expression "As Petroleum Engineering graduates ..." followed by the EPO itself, and then put the expression "Students must be able to…" before each of the indicated outcomes. For example, in the case of EPO 4:

> As Petroleum Engineering graduates to ***exhibit a high level of competence in engineering principles and practice,*** students must be able to *apply knowledge of mathematics, science and technology; design and conduct experiments, and analyze and interpret data; design a system, component or process to meet the desired needs within realistic constraints; understand professional and ethical responsibilities; communicate effectively; recognize the need for lifelong learning and self-learning; know modern problems; use the techniques, skills and modern engineering tools required for engineering practice.*

DESCRIPTORS OF LEVEL AND SCOPE OF KNOWLEDGE, SKILLS AND PROFESSIONAL COMPETENCIES

The Dublin Descriptors adopted in the Dublin Agreement and used in the national higher education standard are comparable, although not identical to criteria, procedures and results of educational programs of the Washington Agreement (1989). These agreements recognize the significant equivalence of accreditation systems, thereby recognizing the significant equivalence of educational programs accredited by the signatories of the agreement.

Thus, the Washington Agreement developed requirements for the professional competencies of engineers and named them as the attributes of the graduate: “The attributes of the graduate form a set of individually assessed learning outcomes that indicate the potential ability of the student to acquire the competencies necessary to perform professional engineering activities at the proper level. Graduate Attributes serve as an example of the requirements that a graduate of an accredited program must meet. The attributes are characterized by clear statements of expected abilities and, where necessary, ranges are provided to indicate the required level of achievement depending on the type of program. "

As noted above, the Department of Petroleum Engineering, in the short term, aims to obtain ABET (Accreditation Council for Engineering and Technology) accreditation, according to which the minimum level of required competencies is Student Outcomes (a) - (k). A more detailed description of the results of students for students under the "Petroleum Engineering" program at KazNRTU named after K. Satpayev is given in Table 4.

At the lower end of the table, there are also descriptions of knowledge, skills and personal and professional competencies according to the industry qualifications framework and compared against the ABET competency requirements. Since knowledge implies a basic minimum level compared to skills and competencies, they are marked in white.

Such a classification of student outcomes is necessary in the future for clear detailing and comparison with the course outcomes, as noted in Fig. 1.

Table 4 – ABET competencies (Criterion 3. Student outcomes), Petroleum Engineering educational program competencies' brief descriptions and their relationship to the industry qualifications framework

ABET competencies (Criterion 3. Student outcomes)										
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
ability to apply knowledge in mathematics, science and technology	ability to design and conduct experiments, and analyze and interpret data	ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability	ability to work in interdisciplinary teams	ability to identify, formulate and solve technical problems	understanding of professional and ethical responsibility	ability to communicate effectively	extensive education required to understand the impact of technical solutions in a global, economic, environmental and social context	recognition of the need for lifelong learning and the ability to learn independently	knowledge of modern problems	ability to use the techniques, skills, and modern engineering tools required for engineering practice.
Petroleum Engineering educational program competencies' brief descriptions										
Apply the methods and principles of engineering sciences to analyze and evaluate various elements, systems, processes of drilling, production and transportation and find the optimal	Understand the meaning, interpret and comment on the information received. Collect and organize a variety of information from multiple sources. Based on the information collected,	Use the fundamental sciences in modeling and calculating methods, modes of drilling oil and gas wells, operating and maintaining oil, gas, condensate production facilities, in designing the development of	The ability to correlate one's aspirations with the interests of other people and social groups; have the skills of working together in a group, the ability to find common goals, and contribute to a common	Be able to methodologically substantiate scientific research. To use the basic methods and techniques of scientific research and analysis of problems, which make it possible to distinguish facts	Critically consider one or another aspect of the development of society, possess the ethics of labor and civil relations; have respect for the professional code of an engineer, a sense of intolerance for violations of	The ability and readiness of the graduate to verbal communication in the professional (educational-professional) and official business spheres in compliance with all the norms of	Analyze the current state of the domestic and world economy, oil and gas industry in a market economy, the ability to assess the adopted or accepted engineering decisions and their impact on public opinion.	Organize planning, analysis, reflection, self-assessment of their educational and cognitive activities; to formulate their own value orientations in relation to the studied subjects and the fields of	Be aware of the development of modern problems of technology and oil engineering in Kazakhstan and abroad, using the ability and possession of the methods of modern educational and information technologies.	Possess software skills in drilling, development, production, gathering and preparation of hydrocarbons, and oil and gas transportation, following the instructions of the management as part of a team of colleagues to

(rational) conditions for their work.	identify trends, reveal causal relationships, determine goals, choose means, and put forward hypotheses and ideas. Collect and summarize field data necessary for drawing up projects for drilling, production, collection and preparation of hydrocarbons, and their further transportation onshore and offshore	oil and gas fields and in production activities. Know and comply with the basic principles of rational nature management and environmental protection rules during the operation and maintenance of oil, gas and condensate production facilities.	cause. Be able to deal with a variety of opinions, disagreements and conflicts, take into account the views of others, be able to negotiate and find compromises.	from speculation, information from opinions, to propose alternative solutions based on the analysis of the current state, to remain open to new ideas, to demonstrate the ability to apply theoretical concepts in practice.	the law. To give a legal and moral assessment of facts, events and actions (including your own). Assess social attitudes related to health, consumption and the environment.	verbal communication : to state orally and in writing the results of their educational and research work; represent yourself, your university, region, country; fill out questionnaires, draw up applications, resumes, letters and other texts of an official business style; have the skills of interpersonal and group communication , public speaking, be able to ask questions, correctly conduct a dialogue, participate in discussions.		activity being mastered. Be able to be flexible in the face of rapid change. Through continuing education, strive to master new profiles of professional activity, expand professional opportunities. Make effective use of the labor market situation, act in accordance with personal and social benefit.		participate in experimental research activities, to be able to compare, analyze and interpret the results of special software programs with alternative methods of obtaining data and with real data.
The industry qualifications framework for petroleum, refining and petrochemical industries 6-Level (Undergraduate)										
Characteristics of skills and abilities:	**Characteristics of skills and abilities:**	**Characteristics of personal and**	**Characteristics of personal and professional competencies:**	**Characteristics of skills and abilities:**	**Characteristics of personal and professional competencies:**	**Characteristics of personal and**	**Characteristics of knowledge:**	**Characteristics of personal and**	**Characteristics of knowledge:**	**Characteristics of skills and abilities:**

1) Solving problems of a technological or methodological nature related to a certain area of knowledge, involving a choice from a variety of solutions.	2) Development, implementation, control, assessment and correction of technological process components	**professional competencies: 3) complexity** (process management, level of control / independence of execution, harmful and difficult working conditions, the use of complex equipment and technologies in the process of labor, work with partial or complete uncertainty).	**1) independence** (teamwork, focus on results, influence on the process, planning and organization / timeliness)	3) Abilities and skills to carry out research and innovation activities to develop new knowledge and procedures for integrating knowledge of various fields, correctly and logically formulate your thoughts in written and oral form, apply theoretical knowledge in practice in a specific area	**2)responsibility** (labor safety and protection, development of subordinates, responsibility for quality, efficiency and timeliness of work)	**professional competencies: 2)responsibility** (labor safety and protection, development of subordinates, responsibility for quality, efficiency and timeliness of work)	1) A wide range of special (theoretical and practical) knowledge (including innovative).	**professional competencies: 1) independence** (teamwork, focus on results, influence on the process, planning and organization / timeliness)	2) Independent search, analysis and evaluation of professional information.	1) Solving problems of a technological or methodological nature related to a specific area of knowledge, involving a choice from a variety of solutions (including innovative ones).

DESCRIPTION OF COURSES

LNG108 – English
CREDITS – 10 (0/0/6/4)
PREREQUISITE – Diagnostic test/LNG1051-1056

COURSE AIM AND OBJECTIVES

Provide students with the opportunity to acquire sufficient knowledge to become more free in their everyday social and academic settings. Students are working to improve pronunciation, vocabulary and grammar. Development of academic language skills. To teach students to work with texts, both audio and written, in their specialty. The discipline is a language style that is used when writing academic papers (paragraph, abstract, essay, presentation, etc.) This course is designed to help students become more successful and effective in their learning, developing critical thinking skills and independent learning.

SHORT DESCRIPTION OF THE COURSE

The courses are designed to teach English to university students who need English for work and communication. The courses are multi-level with the following levels: Beginner English, Elementary English, General English I, General English II, Academic English, Business English, Professional English

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the basics of grammar and apply	✓										
Formulate a topic, determine the linguistic means of organizing the text and use them when producing your own speech works			✓	✓							
Know about the methods and techniques of linguosemantic analysis of a scientific text	✓										
Distinguish the features of the compositional and semantic organization of a scientific text					✓				✓		
Determine the types, volume and types of additional scientific information contained in the text			✓								
Organize and participate in discussions on familiar topics, ask them to repeat and explain some words and phrases.						✓			✓		
Recognize, analyze grammatical structures and vocabulary of academic English in the text	✓				✓			✓			

LNG104 – Kazakh/Russian language
CREDITS – 10 (0/0/6/4)
PREREQUISITE – Diagnostic test

COURSE AIM AND OBJECTIVES

- To teach students to listen to statements on well-known topics related to home, study, free time;
- Understand texts on personal and professional topics containing the most common words and expressions;
- Be able to conduct a conversation on everyday topics; describe your experiences; tell your opinion; retell and evaluate the content of the book read, the film seen;
- Be able to create simple texts on well-known topics, including those related to professional activities.

SHORT DESCRIPTION OF THE COURSE

The language material of the course is selected in such a way that the student, assimilating the lexical and grammatical minimum, had the opportunity to get acquainted with typical communicative situations and himself in such situations found himself, was able to correctly evaluate them and choose the appropriate model (strategy) of speech behavior.

At the same time, the main emphasis of teaching is transferred from the process of transferring knowledge to teaching the ability to use the target language during the implementation of various types of speech activities, which are reading (subject to reading comprehension), listening (under the same condition) and the production of texts of a certain complexity with a certain degree of grammatical and lexical correctness.

The material for classes is selected so that students, while studying the Kazakh / Russian language, acquire the skills of reading, writing and understanding sounding speech based on the simultaneous mastering of the basics of grammar (phonetics, morphology and syntax) and word usage in the course of constant repeated repetition with a gradual complication of tasks.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the basics of grammar and apply	✓										
Formulate a topic, determine the linguistic means of organizing the text and use them when producing your own speech works			✓	✓							
Know about the methods and techniques of linguosemantic analysis of a scientific text	✓										
Distinguish the features of the compositional and semantic organization of a scientific text					✓				✓		

Determine the types, volume and types of additional scientific information contained in the text			✓								

CATALOGUE OF COMPULSORY MAJOR SUBJECT [1]

PET103 - Introduction to major
CREDIT - 5 (1/1/1/2)
PREREQUISIT - no

AIM AND OBJECTIVES OF THE COURSE

This course provides general information about the oil and gas industry and its components: geological and geophysical prospecting for oil and gas fields, drilling oil and gas wells, development and operation of oil and gas fields, collection and preparation of well products, oil and gas transportation, oil and gas processing. At the end of the course, students will have an idea of: the structure of oil and gas fields, equipment and technological operations for drilling, production, collection and preparation, transportation and processing of oil and gas.

BRIEF DESCRIPTION OF THE COURSE

An introduction to the basic concepts and concepts of petroleum engineering, covering topics such as drilling and completions, oilfield development, surface gathering and treatment, transportation and storage.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Describe the basis of the earth's structure, the geochemical cycle of carbon, rock types, classification of sedimentary rocks, tectonic actions			✓								
Describe the oil reservoir and its components, trap elements and their formation, parent rocks, temperature and maturity of organic rocks, maturity of the parent rocks, primary and secondary migration			✓		✓						
Understand the basic procedures and roles of all systems used in drilling					✓						

[1] Please note that during the preparation of this section, syllabuses of academic disciplines of the Kazakh National Research Technical University named after K. Satpayev were used, as well as the available domestic and foreign literature in the field of petroleum engineering.

Development of understanding of various aspects in drilling operations, difficulties associated with the analysis and synthesis of various technical problems encountered during drilling operations			✓		✓						
Understand the basic concepts for the development of oil fields, as well as methods and technologies of oil production					✓						
Know the basic properties of reservoir rocks and fluids, know the methods of their calculation and measurement	✓				✓						
Analyze the main elements in the design and optimization of the mining process		✓	✓								
Demonstrating and understanding the difference between risks and uncertainties and their impact on decision making in the oil and gas industry	✓							✓	✓	✓	
Applying critical thinking and problem-solving skills to petroleum engineering problems	✓							✓			
Applying theoretical and practical skills to analyze petroleum engineering data				✓				✓	✓		

PHYS111-112 – PHYSICS I
CREDITS – 5 (1/1/1/2)
PREREQUISITE – no

COURSE AIM AND OBJECTIVES

The main goal of teaching the course Physics I is to form ideas about the modern physical picture of the world and the scientific outlook.

COURSE DESCRIPTION

Disciplines Physics I is the basis of theoretical training for engineering and technical activities of graduates of a higher technical school and represent the core of physical knowledge necessary for an engineer operating in the world of physical laws. The course "Physics 1" includes sections: physical foundations of mechanics, structure of matter and thermodynamics, electrostatics and electrodynamics.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	Criteries 3. Student's outcomes										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Understand the basic physical phenomena and basic laws of physics, the limits of their applicability, the possibility of using them in practical applications	✓	✓									
Know the basic physical quantities and physical constants, their definition, meaning, units of their measurement	✓			✓	✓						
Analyze and explain natural phenomena and man-made effects from the standpoint of fundamental physical concepts			✓	✓					✓		
Use basic concepts, laws and models of physics, operate with them to solve applied problems.		✓				✓					
Justify which laws describe a given phenomenon or effect, highlight the physical content in applied problems, search and systematize the relevant information					✓				✓		
Compare the meaning of physical quantities and concepts	✓			✓				✓			

MAT101 - Mathematics I
CREDITS – 5 (1/0/2/2)
PREREQUISITE – no

COURSE AIM AND OBJECTIVES

The main goal of the course is to give the future specialist a certain amount of knowledge in the sections of the course "Mathematics-I", which is necessary for the study of related engineering disciplines. Introduce students to the ideas and concepts of calculus. The main attention is paid to the formation of basic knowledge and skills with a high degree of understanding of differential and integral calculus.
The objectives of the course are the acquisition of knowledge necessary for the effective use of rapidly developing mathematical methods; obtaining the skill of building and researching mathematical models; possession of the fundamental sections of mathematics, necessary for solving scientific research and practical problems in the professional field.

SHORT DESCRIPTION OF THE COURSE

The course "Mathematics-I" provides a presentation of the sections: introduction to analysis, differential and integral calculus

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know linear algebra and analytic geometry			✓								
Apply the theory of differential equations and systems of differential equations, numerical and functional series	✓							✓			
Analyze the theory of functions of a complex variable, the theory of probability and mathematical statistics						✓	✓				
Analyze analytic geometry									✓	✓	
Apply methods for solving problems of planimetry and stereometry using analytical geometry			✓								
Distinguish between cartesian and polar coordinate systems					✓						

GEN177 –Engineering and computer graphics
CREDITS – 5 (1/1/1/2)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

Training in the use of modern information technologies in the field of professional activity. The objectives of the course include:
- Teach how to work with software interfaces of operating systems;
- To reveal the concepts of data formats and multimedia content. To teach how to work with typical multimedia data processing applications. Use modern approaches of presentation of the material;

SHORT DESCRIPTION OF THE COURSE

The course develops the following skills among students: to depict all possible combinations of geometric shapes on a plane, to carry out research and their measurements, allowing for image transformations; to create technical drawings, which are the main and reliable means of information that provides communication between the designer and the designer, technologist, builder. Introduces students to the basics of automated preparation of the graphic part of design documents in the AutoCAD environment.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
To know all possible combinations of geometric shapes on the plane, to conduct research and their measurements, allowing for image transformations;	✓										
Create technical drawings that provide communication between the designer and the designer, technologist, builder.		✓						✓	✓		
Explain the work of modern tools with data of various nature and purpose		✓			✓						
Apply the graphic part of design documents in the AutoCAD environment.	✓		✓					✓			

HUM129 – Culturology
CREDITS – 2 (1/0/0/1)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The purpose of studying the discipline is to familiarize students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal laws of the formation and development of culture, to develop their aspirations and skills to independently comprehend the wealth of values of world culture for self-improvement and professional growth.

SHORT DESCRIPTION OF THE COURSE

The course of cultural studies examines the general problems of the theory of culture, the leading cultural concepts, universal patterns and mechanisms of formation and development of culture, the main historical stages of the formation and development of Kazakh culture, its most important achievements.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the general problems of the theory of culture	✓										
Know the leading cultural concepts			✓		✓						
Analyze the main historical stages of the formation and development of Kazakh culture	✓					✓					
Operate with historical concepts						✓			✓		
Analyze complex historical events and predict their further development			✓	✓							

HUM100 – Contemporary history of Kazakhstan
CREDITS – 5 (1/0/2/2)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

- The aim of the course is to familiarize students of technical specialties with the main theoretical and practical achievements of domestic historical science on the problems of the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of the formation and development of Kazakhstani society.
- Analyze the features and contradictions of the history of Kazakhstan during the Soviet period;
- To reveal the historical content of the foundations of the laws of political, socio-economic, cultural processes at the stages of the formation of an independent state;
- Promote the formation of students' citizenship;
- To educate students in the spirit of patriotism and tolerance, belonging to their people, the country;

COURSE DESCRIPTION

The course Modern history of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. The modern history of Kazakhstan studies the national liberation movement of the Kazakh intelligentsia at the beginning of the 20th century, the period of creation of the Kazakh republic, as well as the process of formation of a multinational society.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the events, facts and phenomena of the Modern history of Kazakhstan	✓										
Know the history of ethnic groups inhabiting Kazakhstan			✓		✓						
Analyze the main stages of the formation of Kazakh statehood	✓					✓					
Work with historical concepts						✓			✓		
Analyze complex historical events and predict their further development			✓	✓							

PHY464 - Electromagnetism. Optics
CREDITS – 5 (1/1/1/2)
PREREQUISITE – PHY111

COURSE AIM AND OBJECTIVES

The main purpose of teaching the course "Electromagnetism. Optics" consists in the formation of ideas about the modern physical picture of the world and the scientific worldview.

COURSE DESCRIPTION

Discipline "Electromagnetism. Optics" is a logical continuation of the study of the discipline "Physics 1", and forms a holistic view of the course of general physics as one of the basic components of the general theoretical training of bachelors of engineering and technical profile. The discipline "Physics II" includes sections: magnetism, optics, nanostructures, fundamentals of quantum physics, atomic and nuclear physics.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**

Upon completion of the discipline, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Understand the basic physical phenomena and the basic laws of physics, the limits of their applicability, the possibilities of use in practical applications	✓	✓									
Know the basic physical quantities and physical constants, their definition, meaning, units of their measurement	✓			✓	✓						
Analyze and explain natural phenomena and technogenic effects from the standpoint of fundamental physical concepts			✓	✓					✓		
Use the basic concepts, laws and models of physics, operate with them to solve applied problems.		✓				✓					
To substantiate which laws describe this phenomenon or effect, to highlight the physical content in applied problems, to search and systematize relevant information					✓				✓		
Compare the meaning of physical quantities and concepts	✓			✓				✓			

MAT102 – Mathematics II
Credits – 5 (1/0/2/2)
PREREQUISITE – Math I

COURSE AIM AND OBJECTIVES

The goal of the "Mathematics II" is to form understandings about modern mathematics as a whole as a logically harmonious system of theoretical knowledge.
The objectives of the course are to instil solid skills in solving mathematical problems with bringing the solution to a practically acceptable result. To develop primary skills in mathematical research of applied issues and the ability to independently understand the mathematical apparatus contained in the literature related to the student's specialty.

COURSE DESCRIPTION

The course "Mathematics-II" provides an accessible presentation of sections: elements of linear algebra and analytic geometry, differential calculus of functions of many variables, multiple integrals. "Mathematics II" is a logical continuation of the course "Mathematics I".

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	Criteries 3. Student's outcomes										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Apply functions in the form of power series and Fourier series			✓								
Apply series in approximate calculations (definite integrals and solving Cauchy problems) with an estimate of the errors allowed in this case	✓							✓	✓		
Estimate the probabilities of random events and work with random variables and functions from them					✓						✓
Apply methods for solving differential equations by numerical methods (Euler's method) and using the operational method			✓	✓							
Differentiate functions of one and several variables, calculate definite integrals of functions of one and several (double, triple integrals) variables, both in Cartesian and in orthogonal curvilinear coordinates							✓		✓		

HUM128 – Political Science
CREDITS – 2 (1/0/0/1)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The aim of the course is to form students' systematic knowledge about the political sphere of public life, a consistent and comprehensive study of the origins and evolution of the political thought of the Kazakh people at a long stage of its historical development on the materials of its richest spiritual culture, political heritage and its most prominent representatives.

SHORT DESCRIPTION OF THE COURSE

The study of the discipline "Political Science" makes it possible to determine the place of the systematic approach in the methodology of the study of politics and the regime of government; to reveal its specifics; to analyze the main provisions of the theory of systems and the theory of the political system; to form scientific ideas about the structure, principles, functions of the political system, the mechanism of its functioning; to identify factors contributing to the legitimacy, stability, adaptation of the political system; to study modern models of political systems; to analyze the main types of political regime, their varieties; to form the ability to analyze the features of the development of the political system and the political life of the peoples and states of the Republic of Kazakhstan, their transition to democracy

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	Criteries 3. Student's outcomes										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the general problems of the theory of culture	✓										
Know the leading cultural concepts			✓		✓						
Analyze the main historical stages of the formation and development of Kazakh culture	✓					✓					
Operate with historical concepts						✓			✓		
Analyze complex historical events and predict their further development			✓	✓							

CHEE495 – Chemistry
CREDIT – 5 (1/1/1/2)
PREREQUISITE – no

AIM AND OBJECTIVES OF THE COURSE

The aim of studying the discipline is the fundamental preparation of students in chemistry, contributing to the preparation of the student for interdisciplinary experimental research activities aimed at creating competitive products based on the use of modern methods and design tools, mathematical, physical and computer modeling of technological processes.

BRIEF DESCRIPTION OF THE COURSE

The chemistry course is designed to form an understanding of the basic concepts and laws of chemistry, the properties of organic and inorganic substances, chemical reactions and how to control them.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	Criterion 3. Students' results										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Understand basic chemical phenomena and basic laws of chemistry; the limits of their applicability, the application of laws in the most important practical applications;			✓								

Describe the main chemical quantities and chemical constants, their definition, meaning, methods and units of their measurement;			✓		✓						
Know chemical experiments and their role in the development of science; the purpose and principles of operation of the most important physical and chemical devices.					✓						
Explain the main observed natural and man-made phenomena and effects from the standpoint of chemical interactions;			✓		✓						
Understand the meaning of chemical quantities and concepts; write down the equations of chemical reactions;					✓						
Work with instruments and equipment of a chemical laboratory; use various techniques for processing experimental data.	✓				✓						
Master the use of basic chemical laws and principles in critical practical applications;		✓	✓								
Possess the use of basic methods of chemical analysis for solving natural science problems; correct operation of the main instruments and equipment of the chemical laboratory; processing and interpretation of the results of the experiment.	✓							✓	✓	✓	
Apply critical thinking and problem-solving skills to petroleum engineering problems	✓							✓			
Apply theoretical and practical skills to analyze petroleum engineering data				✓				✓	✓		

HUM132 – Philosophy
CREDITS – 5 (1/0/2/2)
PREREQUISITE – Modern History of Kazakhstan

COURSE AIM AND OBJECTIVES

The aim of the course is the formation of cognitive, rational, communicative, self-educational competencies, the tasks are:
- Promote the development of adequate world outlook guidelines in the modern world;
- To form creative and critical thinking in students;
- Distinguish the ratio of spiritual and material values, their role in the life of a person, society and civilization;
- Contribute to the definition of their attitude to life and the search for harmony with the surrounding world.

SHORT DESCRIPTION OF THE COURSE

"Philosophy" is the formation of a holistic worldview that has developed in the context of the socio-historical and cultural development of mankind. Acquaintance with the main paradigms of the methodology of teaching philosophy and education in the classical and post-classical traditions of philosophy. Philosophy is called upon to develop stable life guidelines, the acquisition of the meaning of one's being as a special form of spiritual production. Contributes to the formation of a moral character of a person with the ability to critical and creative thinking. The theoretical sources of this course are the concepts of Western, Russian, Kazakh scientists on the history and theory of philosophy.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the basic terms, main concepts and problems of philosophy	✓										
Distinguish the main philosophical ways of solving worldview issues in the context of culture			✓		✓						
Analyze the history of the development of philosophical thought											
Determine alternative ways of posing and solving worldview issues in the history of human development			✓					✓			
Identify the main theoretical approaches in the relationship of a person with society		✓			✓						
Discuss and make rational decisions				✓				✓			

CHE451 - Life safety
CREDIT - 2 (1/0/01)
PREREQUISITE - No

AIM AND OBJECTIVES OF THE COURSE
The purpose of the discipline "Life Safety" is to form students' ability to recognize and evaluate negative factors of the human environment

BRIEF DESCRIPTION OF THE COURSE
Students will study the consequences for humans of harmful and damaging factors, ways to implement reliable ways to protect against them, choosing the optimal solution and correct behavior, safety and preservation of life in emergency situations of a natural, man-made and social nature

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, studentsshould be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the harmful and damaging factors of the human environment	✓										
Be able to recognize and evaluate negative factors			✓								
Be able to implement reliable ways to protect against them					✓						
Analyze the causes of harmful and damaging factors		✓									
Evaluate and make optimal decisions and correct behavior					✓						

MAT103 – Mathematics III
Credits – 5 (1/0/2/2)
PREREQUISITE – Math II

COURSE AIM AND OBJECTIVES

The goal of the course "Mathematics-III" is the formation of basic knowledge and skills with a high degree of understanding of the sections of the course, helping to analyze and solve theoretical and practical problems. Objectives of the course: instilling in students the ability to independently study educational literature, to carry out probabilistic-theoretical and statistical analysis of applied problems; development of logical thinking and raising the general level of mathematical culture.

COURSE DESCRIPTION

The course "Mathematics-III" includes sections: the theory of series, elements of the theory of probability and mathematical statistics and is a logical continuation of the discipline "Mathematics II".

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Apply number series theory	✓										

Understand and compare the results of the theory of function series							✓	✓			
Apply Fourier Series to Industry Problems		✓									
Compare elements of probability theory and mathematical statistics						✓					
Evaluate problems in all sections of series theory						✓		✓			
Analyze different probabilities of events and draw conclusions				✓							
Classify numeric characteristics of random variables		✓			✓						
Use statistical methods to process experimental data								✓			

HUM122 – Psychology
CREDITS – 2 (1/0/0/1)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The purpose of the discipline is to study fundamental concepts in the field of general psychology. The general idea of psychology as a science, methodology and methods of psychology are considered. The discipline contributes to the formation of a holistic view of a person's personal characteristics as a factor of success in mastering and implementing their educational and professional activities, the ability to make decisions more effectively based on knowledge of the psychological nature of a person and society. The possibility of using the studied methods in the future professional activity of students is considered.

SHORT DESCRIPTION OF THE COURSE

The object of the discipline is the mental processes, properties and states of a person in various fields of human activity, interpersonal and social interactions, ways and forms of their organization and changes under external influence.
During the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the perspective of psychological aspects.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
To know the mental processes, properties and conditions of a person in various fields of human activity	✓										

Be able to recognize and evaluate interpersonal and social interactions					✓						
Know the ways and forms of interpersonal and social interactions of organization and change	✓										
Analyze the causes of conflicts in various fields of human activity		✓							✓		
Evaluate and make optimal decisions from the perspective of psychological aspects						✓					

MNG487 - Fundamentals of Entrepreneurship, leadership and anti-corruption culture
CREDITS – 3 (1/0/1/1)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The purpose of the discipline is to gain practical skills in entrepreneurial activity, familiarization with the theories and types of leadership, and understanding the basics of anti-corruption culture.

SHORT DESCRIPTION OF THE COURSE

Students will study the theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures. They will develop their leadership and teamwork skills. They will also study the causes of corruption and methods to combat it.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
To know the theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures						✓					
Be able to develop their leadership and teamwork skills.							✓				

Analyze the causes of corruption and methods to combat it.									✓		
Assess uncertainties in risk assessment											✓
Integrate social, political, cultural and environmental factors into the decision-making process.								✓	✓	✓	

GEN408 - Strength of materials
CREDITS – 5 (1/1/1/3)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The purpose of the discipline is the theoretical and practical training of future specialists in the field of technology of transport processes to the extent necessary for the correct solution of the problems of calculating the strength, rigidity and stability of structural elements used in difficult operating conditions under the influence of both static and dynamic loads, the rational purpose of structural materials and the shape of the cross-section, providing the required indicators of reliability, safety, economy and efficiency of the structure.

SHORT DESCRIPTION OF THE COURSE

The object of the discipline is Stretching and compression, Stresses in cross sections and deformations of a straight rod, Mechanical properties of materials under tension and compression. Calculation of strength and stiffness in tension-compression. Geometric characteristics of flat sections. Shear and torsion. Calculation of strength and torsional stiffness. Bend. Normal and tangential bending stresses. Calculation of bending strength. Theory of stressed and deformed states. The limit state hypothesis. Complex resistance. Stability of the equilibrium of deformable systems. Dynamic load.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
To know the main tasks and possibilities of the science of the resistance of materials			✓								
Know the principles of drawing up calculation schemes					✓						

To know the main tasks and possibilities of the science of the resistance of materials		✓									
Be able to apply methods for calculating structural elements for strength, rigidity and stability		✓									
Evaluate and analyze the results obtained by engineering calculations											✓

CHE559 - Chemistry of Oil and Gas
CREDIT - 5 (2/1/0/2)
PREREQUISITE - Chemistry

AIM AND OBJECTIVES OF THE COURSE

Formation and deepening of knowledge in the field of oil chemistry: about the composition and properties of oil systems, gases of various origins; on the methods of their research, familiarization with the technological classification of oil refining processes, acquaintance with the characteristics of oil as a raw material for distillation processes.

BRIEF DESCRIPTION OF THE COURSE

The discipline gives an idea about the composition and properties of oil systems of various origins, about the methods of their study; the study of differences in the structure and physicochemical properties of individual hydrocarbons as the main components of oils, natural gases and other types of hydrocarbon raw materials, methods for separating multicomponent oil systems, the reasons for the formation of oil dispersed systems and their colloidal chemical properties, hypotheses of the origin of oil.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Understand the main production processes that represent a single chain of oil and gas processing;			✓								
Describe the main properties of oil and gas hydrocarbons;			✓		✓						
Know the hypotheses of organic and inorganic origin of oil and gas;					✓						
Know the principles of classification of oils and gases;			✓		✓						

Describe the properties and patterns of behavior of oil as a dispersed system.					✓						
Use knowledge about the composition and properties of oil and gas in the appropriate calculations.	✓				✓						
Master the methods of studying the physical, chemical and mechanical properties of oil and gas.		✓	✓								
Possess the use of basic methods of chemical analysis for solving natural science problems; correct operation of the main instruments and equipment of the chemical laboratory; processing and interpretation of the results of the experiment.	✓							✓	✓	✓	
Apply critical thinking and problem-solving skills to petroleum engineering problems	✓							✓			
Apply theoretical and practical skills to analyze petroleum engineering data				✓				✓	✓		

GEN408 - Solving the problems of oil and gas engineering
CREDITS – 5 (1/0/2/2)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The purpose of the discipline is to consider case problems with the industry and their solution, which includes the topics of engineering and technology in drilling, mining, development and transportation; safety, labor protection, management.

SHORT DESCRIPTION OF THE COURSE

Analyze and summarize experimental data on production problems, improve methods of operation and maintenance of equipment, apply innovative methods to solve production problems, design and develop new innovative technological processes and equipment for oil and gas production and transportation of oil and gas, manage the complex technological process of development, operation and transportation of oil and gas.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	Criteries 3. Student's outcomes										
Upon completion of the discipline, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Know the main causes of production tasks			✓								

Know the principles of improving the methods of operation and maintenance of equipment		✓									
Be able to manage the complex technological process of development, operation and transportation of oil and gas					✓						
Be able to apply innovative methods to solve production problems								✓			
Evaluate and analyze the results obtained by experimental data		✓									

CSE677 – Information and communications technologies
CREDITS – 5 (2/1/0/2)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

Training in the skills of applying modern information technologies in the field of professional activity. The objectives of the course include:
- To reveal the basic concepts of the architecture of computer systems;
- To reveal the basic concepts of information and communication technologies and subject terminology;
- To teach to work with software interfaces of operating systems;
- To teach how to work with data in a different presentation, both tabular structured and unstructured form;
- Teach to apply the basic principles of information security;
- To reveal the concepts of data formats and multimedia content. To teach how to work with typical applications for processing multimedia data. Use modern approaches to material presentation;
- To reveal the concepts of modern social, cloud and email platforms, and how to work with them;
- To teach how to use algorithms and programming methods to solve problems of automating business processes.

SHORT DESCRIPTION OF THE COURSE

The course contains a training program aimed at leveling the basic knowledge of students in the field of information and communication technologies. Contains a full range of topics with a predominance of training practical skills in working with data, algorithms and programming. The course is designed in such a way as to teach students not only the basic concepts of architecture and modern infrastructure of information and communication technologies, but also to teach how to use these tools to solve applied problems. To teach how to optimize processes, apply adequate models and methods for solving practical problems using modern methods and tools of information technology, automate routine processes, be productive and efficient.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	Criteries 3. Student's outcomes										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the architecture of computing systems and information communications technology infrastructure	✓										
Compare interfaces of modern operating systems		✓						✓	✓		
Distinguish between types of information security threats, principles, tools and methods of data protection			✓			✓			✓		
Explain how modern tools work with data of various types and purposes		✓			✓						
Program in an algorithmic programming language;					✓				✓		✓
Analyze, model, design, implement, test and evaluate information and communication technology systems			✓			✓					✓
Apply modern social, cloud, email platforms to organize business processes	✓		✓					✓			

HUM127 - Sociology
CREDITS – 2 (1/0/0/1)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES

The main purpose of the course "Sociology" is to form students' understanding of sociology as an academic and applied discipline - mastering the system of basic sociological concepts, mastering the basic methods of empirical sociology, familiarization with the application of sociological approaches to the study of social phenomena and processes. The study of the basics of sociology plays an important role from the point of view of personal development and socialization, helps students to scientifically comprehend complex phenomena and processes of social life, their essence, content, dynamics of development, as well as to understand existing sociological theories that explain these social phenomena and processes and reveal the mechanisms of their research.

SHORT DESCRIPTION OF THE COURSE

Background and socio-philosophical prerequisites of sociology as a science. Classical sociological theories. Society and social institutions. Social groups and communities. Types of communities. Small groups and

collectives. Social movements. Social interaction and social relations. Interaction of economy, social relations and culture. Social changes. Methods of sociological research

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the socio-philosophical prerequisites of sociology			✓								
Know the principles of the organization of society and its social institutions		✓									
Be able to analyze the interaction of economics, social relations and culture								✓			
Apply research methods to analyze the interaction of society and personality								✓			
Be able to apply the methods of sociological research		✓									

CHE452 - Ecology and sustainable development
CREDITS – 2 (1/0/0/1)
PREREQUISITE – No

COURSE AIM AND OBJECTIVES
The purpose of the course is to form an idea of the basic laws of sustainable development of nature and society.

SHORT DESCRIPTION OF THE COURSE
The course examines the ecology of individuals, populations and communities, biogeocenosis. Ecosystem. The biosphere and its stability. Principles of sustainable development. Modern global and topical environmental problems of Kazakhstan and ways to solve them. The best available technologies as effective ways of sustainable

development. Overview of advanced domestic industries, ways and means of protecting the environment from the negative impact of human production activities.

COURSE OUTCOMES: KNOWLEDGE, SKILLS AND ABILITIES

Course outcomes – student outcomes matrix

COURSE OUTCOMES	**Criteries 3. Student's outcomes**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the socio-economic aspects of ecology			✓								
Know the principles of sustainable development.		✓									
Be able to analyze the causes of modern environmental problems in Kazakhstan					✓						
Apply the best available technologies for sustainable development.					✓						
Be able to apply environmental monitoring methods		✓									

PET411 – Reservoir rock properties
CREDITS – 5 (2/1/0/2)
PREREQUISIT – GEO134 Oil and gas geology

COURSE AIM AND OBJECTIVES
Familiarization of students with the essence of the basic physical processes in rocks, with the basic petrophysical properties of rocks and their relationship.

SHORT DESCRIPTION OF THE COURSE
Systemic theoretical and laboratory study of the physical properties of reservoir rocks: lithology, permeability, elastic properties, rock strength, acoustic properties, electrical properties, relative and effective permeability, oil or water saturation, capillary characteristics, rock-fluid interactions such as adsorption and absorption.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes

Course outcomes	Criterion 3. Student outcomes										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Determine porosity, what factors affect it, and describe methods for measuring porosity	✓				✓						
Determine the elastic and acoustic properties of rocks, the strength of rocks, and the factors affecting them	✓				✓						
Determine the compressibility of rocks and describe methods for assessing the value of the compressibility of rocks	✓	✓									
Determine the permeability and factors influencing it, and describe how the permeability is measured	✓	✓			✓						
Reproduce Darcy as a differential equation, explain the meaning, integrate the equation for a typical reservoir system, and calculate the effects of faults and channels	✓	✓			✓						
Explain the boundary tension and wettability and their effect on capillary pressure, convert capillary pressure from laboratory to reservoir conditions	✓	✓			✓						
Describe the methods used to determine the saturation in reservoir rocks and be able to show the relationship between saturation and capillary pressure	✓	✓			✓						
Determine electrical properties of rocks, resistivity index, saturation index, and cementation factor. Show their relationship and how they are used. Conduct experiments to measure the electrical properties of rocks, the ability to perform calculations required for the analysis of laboratory work	✓	✓			✓						
Determine the effective and relative permeability, reproduce the curves of the relative permeability and show the influence of the history of changes in saturation on the curves of the relative permeability. Show how and where the relative permeability data is used.	✓	✓			✓						
Determine adsorption and absorption. Conduct an experiment to measure the maximum gas sorption in shale	✓	✓			✓						
Develop data analysis skills and be able to draw up reports on the work done		✓					✓				

PET409 - Thermodynamics and Heat Engineering
CREDIT – 5 (1/0/2/2)
PREREQUISIT – PHY112 Physics II

COURSE AIM AND OBJECTIVES

The purpose of the course: the formation of students' fundamental knowledge on the assessment of the basic methods of transformation and transmission of energy, which are the basics of creating technologies for thermal effects on oil reservoirs, maintaining reservoir pressure in oil, gas, and gas condensate fields and processing the bottomhole zone of oil and gas wells, and designing thermal installations in the oil and gas industry.
The main objective of the course is to study the laws of thermal movement and its transformation into other types of movement and methods of obtaining heat, converting it into other types of energy, distribution, transportation, use of heat using heat machines, apparatus, and equipment in the oil and gas industry.

SHORT DESCRIPTION OF THE COURSE

The discipline describes the basic laws and design relationships of thermodynamics and heat transfer, the principle of operation of the working processes of heat engines, heat power plants, refrigeration machines, and steam generators.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes matrix

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Understand the basic laws and design relationships of thermodynamics and heat transfer,			✓								
Describe the purpose, composition, and properties of working bodies of heat engines and refrigerating machines,			✓		✓						
Know the basics of determining the thermodynamic and thermophysical properties of gases, liquids, and solids					✓						
Know the principles of operation of heat and power and heat exchangers.			✓		✓						
Perform calculations and analysis of thermodynamic processes in energy technology equipment.	✓				✓						
Perform calculations and analysis of the temperature regimes of systems and equipment for production, transport, storage, and processing of hydrocarbons,		✓	✓								

Understand and apply the obtained theoretical knowledge in the development of special disciplines in the oil and gas direction.	✓							✓	✓	✓	
Understand and use the methods of drawing up energy and heat balances of energy technological processes in the oil and gas industry,	✓							✓			
Know the methods of calculating the thermal conditions of systems and equipment.				✓				✓	✓		

PET410 - Fluid and Gas Mechanics
CREDIT - 5 (1/1/1/2)
PREREQUISITE - no

AIM AND OBJECTIVES OF THE COURSE
Studying methods of calculation, analysis, design of hydraulic and gas systems, development of engineering calculation skills and mastering the technique of solving basic problems.

BRIEF DESCRIPTION OF THE COURSE
Continuous fluid model; ways of setting the motion of a continuous medium; decomposition of the motion of an elementary volume of a continuous medium into quasi-solid and deformation; mass conservation law and continuity equation; distribution of forces in a continuous medium; the law of change in the quantities of motion and the equations of dynamics in stresses; the law of moments and symmetry of the stress tensor; the law of kinetic energy change and the general law of conservation of energy in continuum mechanics.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the conservation equations on which the theoretical study of hydromechanics is based;			✓								
Be able to investigate the movement of liquids and gases by physical and mathematical methods;			✓		✓						
Possess the theoretical foundations of fluid and gas mechanics.					✓						

Know the principles of classification of oils and gases;			✓		✓						
Describe the properties and patterns of behavior of oil as a dispersed system.					✓						
Be able to use knowledge of oil and gas properties in appropriate calculations.	✓				✓						
Master the methods of studying the mechanical properties of oil and gas.		✓	✓								
To be able to apply the fundamental laws of nature (conservation of mass, energy, momentum, etc.) to establish the basic laws of motion of liquids and gases.	✓							✓	✓	✓	
Apply the basic laws of fluid and gas mechanics to calculate the definition of head loss	✓							✓			

GEO487- Geology and mineral resources of Kazakhstan
CREDITS – 5 (2/1/0/2)
PREREQUISITE – No

AIM AND OBJECTIVES OF THE COURSE

The purpose of this discipline is to acquire practical skills by students in reading geological maps, constructing geological sections, stratigraphic columns, geological maps, and qualitatively describing the geological structure of an area using a geological map and the history of geological development. The main purpose of studying the discipline is for students to acquire basic skills in the geology of mineral resources of Kazakhstan, including the ability to describe rocks, layers and the structure of the Earth's crust, which are associated with the occurrence, migration and accumulation of oil and gas deposits.

BRIEF DESCRIPTION OF THE COURSE

An idea is given about the geological structure of the subsoil and the development of the Earth's crust within the territory of Kazakhstan, about the mineral resources of Kazakhstan, their classification, reserves, priority and strategic types of raw materials. Tasks of the Geological Survey of Kazakhstan at the present stage. The course contains information about the main types of mineral resources, the country's long-term availability of them and priorities in the mineral resource complex.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	Criterion 3. Students' results

Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the basics of the theory and practice of oil and gas geology;			✓								
Be able to study the movements of liquids and gases by physical and mathematical methods;			✓		✓						
Possess methods of obtaining information about geological objects and organizational and legal means of obtaining permits for subsurface use;					✓						
Know the trends in the development of prospecting, exploration and development of oil and gas fields			✓		✓						
Describe methods for displaying information about geological objects obtained during the study of deposits					✓						
To use physical patterns in assessing the prospects of the territory for the search for deposits	✓				✓						
Apply mathematical methods in solving typical geological problems; competently use regulatory legal acts when working with documentation.		✓	✓								
Possess the skills of independent study and analysis of new theoretical developments in the field of oil and gas geology;	✓							✓	✓	✓	
Apply methods of economic assessment of the efficiency of hydrocarbon extraction;	✓							✓			
Apply methods for monitoring the efficiency of field development and extraction of hydrocarbon reserves.											✓

PET412 – Oil and gas well drilling
CREDITS – 5 (2/1/0/2)
PREREQUISIT – no

COURSE AIM AND OBJECTIVES

Teaching students the basics of well construction technology, well design, scientific understanding of the main technological processes and operations in oil production. The acquired knowledge contributes to the formation of the bachelor's skills in drilling and oil and gas wells.

SHORT DESCRIPTION OF THE COURSE

The discipline describes modern methods of drilling oil and gas wells, drilling methods, well design, selection of a drilling pattern and calculation of the influence of parameters on the method of drilling and the effect of drilling fluid on drill bit performance, as well as their impact on the operating costs of drilling 1 meter. Students will also learn about drilling difficulties and challenges and mitigation techniques, directional drilling, offshore drilling and platform design, drilling performance, labor, and environmental safety practices.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Design and evaluate the drilling system, identify problems and propose solutions for well geometry, including directional and horizontal	✓	✓	✓		✓						
Calculate pump-to-bit pressure at each stage of drilling operations based on rheological models and drilling hydraulics according to API standards.	✓	✓			✓						
Make a casing design, taking into account pore pressure and fracture gradient	✓	✓	✓								
Establish an adequate well control procedure to ensure personnel safety and environmental protection.	✓		✓		✓		✓				
Design a proper well cementing procedure, taking environmental and legal considerations into account	✓		✓		✓	✓					

PET415 – Reservoir fluid properties
CREDITS – 5 (2/1/0/2)
PREREQUISIT – PET409 Fluid and Gas Mechanics

COURSE AIM AND OBJECTIVES

This course is designed to form fundamental knowledge of determining the properties of reservoir fluids.
Objectives of the course: a study of methods for determining the composition and physical properties of formation fluids; formation of skills in assessing and analyzing the physical properties of reservoir fluids in the conditions of their natural occurrence and during the development of hydrocarbon deposits; formation of skills in determining the properties of formation fluids.

SHORT DESCRIPTION OF THE COURSE

This discipline covers the basic concepts of reservoir fluids encountered during the drilling and completion of well operations. For example, phase behavior, density and viscosity of a fluid, interfacial tension, and compositional content of fluids. Interpretation of laboratory data for engineering applications is carried out. Calculation of K-value and phase state. An introduction to working with fluid properties software.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes matrix

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Describe how the physical properties of a hydrocarbon are altered by molecular structure, size, pressure, and temperature. Explain the physical significance and assess the impact of fluid properties in field development and production.											✓
Calculate volumetric coefficient, viscosity, gas factor, density of oil, water and gas, z-factor (for single or multiphase fluid), and interfacial tension	✓										
Calculate the properties of gas, oil and formation water (z-factor, density, viscosity) using correlations with various parameters (gas and oil content, American Petroleum Institute density, gas density, salinity, saturation pressure, and temperature)					✓						
Calculate wet gas specific gravity using recombination of production data (composition at surface or separator conditions, or gas properties in a separator).					✓						
Describe laboratory procedures for the study of reservoir fluids and calculate reservoir fluid properties (volumetric ratio, GOR) from PVT data	✓		✓		✓						

Determine and analyze the values of the volumetric ratio, GOR, bubble point pressure, and compressibility from PVT analysis data and from historical production data (pressure and rate)					✓						
Design the optimal working conditions of the separator using the data obtained from the simulation study of the PVT test		✓	✓		✓						
Determine and analyze the dependence of oil viscosity on oil temperature and density in laboratory conditions		✓									
Determine and analyze the dependence of interfacial tension on temperature and the type of mixture: oil, water, and surfactant in laboratory conditions.		✓									
Calculate phase boundaries (saturation and condensation pressures), two-phase equilibrium separation, considering the total composition of the mixture, pressure (or temperature), equilibrium relations (k-values) from an ideal solution model, from correlation, or from tables	✓				✓						
Evaluate and design a hydrate inhibition scheme using PVT study simulation data to assess the economic and technical impact of inhibitors, their concentration at the temperature and pressure of hydrate formation		✓									✓

PET416 - Reservoir Engineering I: Primary Recovery
CREDITS – 5 (1/0/2/2)
PREREQUISIT – no

COURSE AIM AND OBJECTIVES

Course objectives: to reveal the basic concepts that underlie the development of oil fields; demonstrate the application of the material balance method in the development of oil fields; generalize knowledge about reservoir development modes for use in the material balance equation; to demonstrate the derivation of the basic differential equation of radial filtration, the equation of quasi-steady-state and steady-state inflows into the well; reveal the concept of water inflow into the reservoir; demonstrate calculations to predict oil and gas production; familiarize with the basics of immiscible displacement, compare possible scenarios of immiscible displacement.

SHORT DESCRIPTION OF THE COURSE

This course covers material balance calculations for natural gas, retrograde condensate, black oil and volatile oil systems with and without a gas cap, and water pressure. Students will also learn analytical methods for predicting reservoir performance using material balance and production decline curve analysis.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Derive and use the material balance equation for gas systems in combination with forecasting		✓			✓						
Derive and use the equation of material balance of oil systems in combination with forecasting		✓			✓						
Derive and describe the theory of immiscible frontal displacement and its application					✓						
Design 5-point waterflooding and forecast production and injection			✓								
Determine the mechanisms and associated application conditions and their appropriateness for general auxiliary and tertiary enhanced oil recovery methods											✓
Introduction to Performance Analysis of Unconventional Hydrocarbon Reservoirs					✓						

PET418 - Petroleum Engineering Seminar
CREDIT - 5 (2/1/0/2)
PREREQUISIT - no

AIM AND OBJECTIVES OF THE COURSE
Develop students' general skills needed in the research finding, writing research papers, as well as public speaking.

BRIEF DESCRIPTION OF THE COURSE
Introduction to Scientific Research; the structure of the thesis project, ethical issues; choice of research direction; study of the state of the art of research; analysis of scientific literature; patent search; research methodology; planning an experiment; determination of measurement error; structure and preparation of a scientific article;

preparation of presentation for defense; structure and preparation of the "Proposal for scientific research"; public speaking skills; information content of the speech.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Prepare an introduction for the article / presentation, consisting of the relevance of the study, a literature review of previous work, the need for further study and research objectives					✓		✓		✓		✓
Prepare a section "Methodology" for the article / presentation, including objectives, data and methods used, as well as assumptions made in the study			✓		✓		✓		✓		✓
Summarize results in appropriate text, tabular, and graphical forms that comply with Society of Petroleum Engineers (SPE) Presentation Standards		✓					✓				✓
Prepare a "Discussion" section for the report / presentation, including analysis and interpretation of research results		✓			✓		✓		✓		✓
Prepare a Bibliography section in accordance with the SPE style guide, including listing all literature referenced in the technical part of the report					✓	✓	✓		✓		

PET422 - Reservoir Engineering II: Secondary and tertiary recovery
CREDITS – 5 (1/0/2/2)
PREREQUISIT – PET416 Reservoir Engineering I: Primary Recovery

COURSE AIM AND OBJECTIVES
The aim of this course is to develop students' skills to apply analytical and numerical tools to predict incremental oil production.

SHORT DESCRIPTION OF THE COURSE
This discipline covers methods of maintaining reservoir pressure by water injection and gas injection into a gas cap; enhanced oil recovery (EOR) methods such as thermal, gas, chemical and microbiological. Students will also learn about the difficulties and challenges in choosing methods for hydrocarbon production.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Determine the basic principles of building a development system over the field;	✓										✓
Know the methodological principles of calculating the technological indicators of the development of oil deposits under various conditions	✓				✓						✓
Be able to recognize the mechanism of the filtration process of formation fluids for the conditions of a particular field (reservoir);	✓			✓	✓						✓
Apply in practice engineering calculation methods, assessing the effectiveness of elements of the development system;	✓	✓			✓						✓
Know the properties and composition of chemicals used in various oil recovery technologies.	✓			✓	✓						✓
Assess the effectiveness of geological and technological activities carried out at the fields;	✓		✓		✓					✓	✓
Possess the methodology of engineering calculations of technological indicators of oil field development;	✓			✓	✓						✓

PET422 – Well log analysis
CREDIT - 5 (2/1/0/2)
PREREQUISITE - PET176 Rock Properties

AIM AND OBJECTIVES OF THE COURSE
The aim of this course is practical skills in the analysis and interpretation of GIS data.

BRIEF DESCRIPTION OF THE COURSE
Fundamental principles of rock physics, types of logging tools, analysis of open holes, determination of permeability, formation evaluation without clay and clay sand formations, determination of water saturation, Archie's equation, productive strata, oil and gas saturation, recoverable reserves, principles of drilling mud logging , sonic logs, neutron logs, resistivity and density logs, and lithology plots.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	Criterion 3. Students' results										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Determine the basic physical principles of open hole logging to evaluate reservoir properties	✓										✓
Make interpretation of open hole log data to determine lithology, permeability, water saturation, taking into account limitations and uncertainties	✓				✓						✓
Calculate baseline logging data on software	✓			✓	✓						✓
Integration of log data and data from core analysis to determine lithology, permeability, saturation and permeability	✓	✓			✓						✓
Work with log data to create cross-sectional maps and calculate reservoir volumes and hydrocarbons	✓			✓	✓						✓
Determine how well log data can be used in integrated reservoir assessment.	✓		✓		✓					✓	✓
Introduction to evaluation of source rock rich in organic matter, and evaluation of the total organic content using a data logging	✓			✓	✓						✓

PET426 – Well completion
CREDITS – 5 (2/0/1/2)
PREREQUISIT – PET101 Drilling in oil and gas industry

COURSE AIM AND OBJECTIVES

The aim of this course is to create an effective connection between the completion of well drilling and further operation.

SHORT DESCRIPTION OF THE COURSE

Well casing and reservoir isolation: the selection of well design, casing, design, and calculation of casing strings, cementing of casing strings, materials, and equipment for cementing, calculation of well cementing. Opening and sampling of productive horizons. Development, testing, and commissioning of wells. Technical design for the construction of a well offshore. Complications and accidents during drilling offshore.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Understand the design of wells, methods, techniques, and technology for their construction.	✓										✓
Calculate the quantitative and qualitative indicators of well construction.	✓				✓						✓
Know the main problems of well completion and their solutions;	✓			✓	✓						✓
Know the main problems of subsoil and environmental protection during drilling wells.	✓	✓			✓						✓
Be able to perform basic calculations related to well completion using reference literature.	✓			✓	✓						✓
Possess the basic methods of manual and computer calculations related to well completion.	✓		✓		✓					✓	✓
Be able to formulate requirements for drilling companies to improve the quality of well construction.											
Analyze the current situation in the well taking into account its design, drilling technology, and operating conditions.	✓			✓	✓						✓

PET425 – Petroleum Production Engineering
CREDITS – 5 (1/1/1/2)
PREREQUISIT – PET103 Introduction to Petroleum Engineering

COURSE AIM AND OBJECTIVES

Formation of knowledge among students of methods of hydrocarbon production in the aspect of practical application in professional activities.

SHORT DESCRIPTION OF THE COURSE

This course covers the fundamental principles of production engineering and technology, empirical decline curve analysis models, and the future performance of natural oil and gas wells. Some topics include well completions, artificial lift design, sucker rod pumps, gas lift, screw pumps, electric submersible pumps, nodal analysis.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course outcomes – student outcomes

Course outcomes	**Criterion 3. Student outcomes**										
Upon completion of the course, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Evaluate production performance of vertical and horizontal wells in oil, gas, and two-phase reservoirs, including inflow in the reservoir and flow in the well	✓		✓		✓						✓
Evaluate bottomhole problems in oil and gas well production, arising from reservoir clogging and well completion, and evaluate the impact on production.	✓		✓	✓	✓						✓
Justify the selection of well completion options, including perforation, screen, perforated liner, and gravel pack			✓								
Diagnose problems during production, identify the source of the problem in the production system and select the correct stimulation or mechanized method to solve the problem			✓		✓						✓
Design and optimize the hydraulic fracturing process in vertical and horizontal wells in conventional and unconventional reservoirs	✓		✓		✓						✓
Select the right stimulation techniques to improve production performance in	✓			✓	✓						✓

conventional and unconventional reservoirs (fracturing or acidizing)											
Recognize environmental issues during production						✓		✓		✓	✓

PET455 - Fundamentals of Data Analytics and Programming for Petroleum Engineers
CREDITS – 5 (1/1/1/2)
PREREQUISITE – No

AIM AND OBJECTIVES OF THE COURSE

The main purpose of studying the discipline is the acquisition by students of basic skills in assessing reliability and predicting complications during the operation of equipment in the oil and gas industry, selecting methods to increase oil recovery, optimizing transport routes, as well as predicting the effectiveness of the development of new fields.

BRIEF DESCRIPTION OF THE COURSE

The discipline covers topics such as probability theory, regression, correlation, creation of scripts and modules for calculating data during reservoir assessment, development and drilling

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Know the basics of probability theory, regression, correlation	✓										
Own programs for creating scripts and modules for computing	✓										
Be able to describe patterns in reservoir assessment, development and drilling		✓									
Apply mathematical methods in describing reliability assessment and predicting complications			✓								

Apply mathematical methods in predicting the efficiency of the development of new deposits			✓								

PET436 - Economic evaluation of oil and gas projects
CREDIT - 5 (1/0/2/2)
PREREQUISITE - no

AIM AND OBJECTIVES OF THE COURSE
The purpose of this course is to develop students' practical skills in calculating the economic efficiency of oil and gas projects.

BRIEF DESCRIPTION OF THE COURSE
Enterprise as a business object. Market communication of enterprises. Enterprise economic resources and resource management. Production costs and cost of production. Financial results and operational efficiency of the enterprise. Investment and innovation policy of the enterprise. Organization of production, the basics of organizing production processes, organization of continuous production. Human resources and personnel policy of the enterprise in labor resources. Remuneration for labor. Organization of material, technical and instrumental services of production processes.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Classify oil reserves and estimate proven reserves using the volumetric method, production decline curve and material balance (p / z); also, predict production over time.											✓
Indicate in the form of a summary report the main forms of ownership of oil resources, laws, fiscal systems and financial interests associated with their exploitation in Kazakhstan and at the international level.								✓			
Conduct a standard analysis of cash flow for oil projects and determine the acceptability of the proposed projects, and highlight the most attractive in the list of eligible projects.											✓
Estimate uncertainties in reserve estimates and economic valuation											✓
Combine social, political, cultural and environmental factors in the decision-making process.								✓	✓	✓	

PET435 - Design and Operation of Oil and Gas Facilities
CREDIT - 5 (1/0/2/2)
PREREQUISITE - PET160 Technology and Equipment of Oil Production

AIM AND OBJECTIVES OF THE COURSE

The acquisition of theoretical and practical knowledge by students on the basics of design and development of oil and gas facilities, the physical foundations of the process of gathering and preparation of oil, gas and water, substantiation of calculations of the technology of preparation of well products in oil and gas fields.

BRIEF DESCRIPTION OF THE COURSE

This course covers the study of land structures required in the oil and gas industry. Topics discussed: pressure gathering system, taking into account the size and configuration of the oil field area; separation of oil from gas; main purposes and types of oil and gas separators; calculation of separators taking into account the throughput of gas and liquid; classification of pipelines; prevention of contamination and clogging of pipelines and their cleaning methods; oil processing; oil emulsions and their properties; basic methods of destruction of oil emulsions; purposes and types of tanks.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to ...	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Describe the main components (including functions, materials and health, environment and safety) and methods used in the production of oil and gas wells							✓				
Describe the main components (including functions, materials and health, environment and safety) that include oil and gas production facilities, surface separation facilities, and onshore and offshore fluid measurements							✓				
Calculate the expected fluid pressure losses through the components of the oil production system.	✓				✓						
Recommend appropriate stimulation technologies based on well design, rock and fluid properties, and flow characteristics	✓		✓								
Select and design an appropriate artificial lift method based on well design, rock and fluid properties, and flow characteristics	✓		✓								

Recognize the need and recommend the best sand control method	✓		✓								
Identify the types of trouble-free flow problems that can be expected under specific fluid properties and production conditions	✓		✓								
Design, conduct and analyze the results of laboratory experiments to illustrate one- and two-phase flows and filtration modes	✓	✓									
Design, conduct and analyze laboratory experiments to confirm fluid pressure losses in tubing / pipelines for single-phase and two-phase flow, to confirm separator performance in three-phase flow and to confirm pump performance in single-phase flow.	✓	✓									

ECA103 – Diploma project defense
CREDIT - 6
PREREQUISIT – no

AIM AND OBJECTIVES OF THE COURSE
Development of students' skills to work both in a team and individually; analysis and interpretation of the data obtained; development of new solutions; justification of the decisions made, as well as the results obtained.

BRIEF DESCRIPTION OF THE COURSE
It is a mandatory component of the final certification of students.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Collect information, make calculations and / or analyze data to achieve specific goals of the thesis and solve engineering problems in the oil and gas industry		✓	✓		✓				✓		✓
Summarize the results of research paper in the text, tabular and graphic forms corresponding to GOST standards		✓					✓				✓
Привести соответствующие выводы из дипломной работы в соответствии с целями		✓	✓		✓		✓		✓		

проекта, подтвержденные данными, расчетами и / или анализом											
Determine the limitations of the work performed and make recommendations for further research, if necessary, supported by evidence presented in the results and discussions of the study		✓	✓		✓		✓		✓		
Determine the significance, potential benefits and possible applications of the results and conclusions of the thesis			✓		✓		✓	✓	✓		
Title the project and write an abstract of the article / presentation of the thesis at the conference							✓				
Prepare slides of thesis in Microsoft PowerPoint that can be used in an oral presentation to demonstrate that research results, conclusions and recommendations are correct and useful							✓				✓
Present the results of the thesis orally to a group of petroleum engineers and trainers in 15-20 minutes using PowerPoint slides							✓				

ET441 - Multidisciplinary petroleum project
CREDIT - 5 (2/1/0/2)
PREREQUISITE - no

AIM AND OBJECTIVES OF THE COURSE
The aim of this course is to develop students' skills for effective teamwork and communication with colleagues, with the leader, and with industry representatives.

BRIEF DESCRIPTION OF THE COURSE
This course provides a multidisciplinary environment for students to integrate knowledge of geology, geophysics, and petroleum engineering to solve real-life problems in the oil and gas industry. Students work in teams and, at the end of the course, present the results of their work orally and in writing.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**

Work effectively, focusing on the evaluation of their peers and instructors				✓							
Explain what data and specific methods are needed to solve the main problems in the project.			✓		✓						✓
Describe the various technical, economic, social, political or other constraints that need to be considered during the various steps of the decision-making process.		✓		✓				✓		✓	✓
Apply design principle to solving a technical problem		✓	✓								
Predict and optimize performance using appropriate tools.			✓	✓	✓						✓
Examine uncertainty in data, discuss possible implications for results, and consider ways to minimize risks.			✓					✓			
Effectively present engineering research results in a written report.							✓				

ELECTIVE DISCIPLINE CATALOG
PET417 - Petroleum regulations and practices
CREDIT - 5 (2/0/1/2)
PREREQUISIT – no

AIM AND OBJECTIVES OF THE COURSE
The main goals and objectives of the discipline: formation of knowledge about the basic principles, concepts, subsoil use, the structure and content of legal relations in the field of subsoil use, the legislative array governing relations related to the use of subsoil, applicable norms of international treaties and agreements.

BRIEF DESCRIPTION OF THE COURSE
This course covers the main aspects of oil and gas business law. It covers topics such as the science and engineering basis of oil and gas legislation, energy policy, and oil and gas leases. This course focuses on the legal regulations governing the development of private mineral rights, which often also apply to public resources. It covers topics such as the nature, protection and transfer of oil and gas rights, leasing and taxation.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Understand the general provisions and concepts of the regulatory framework of Kazakhstan		✓									✓
Know the types of transactions and documentation	✓					✓	✓				
Know the subsoil use right		✓		✓		✓					✓
Know the process and sequence of preparing a draft subsoil use contract			✓					✓			
Know the conditions for offshore exploration and production		✓					✓				
Know the conduct of oil operations within the safety zone		✓						✓			
Draw up a working program and a project of prospecting works		✓									
Understand the specifics of granting subsoil use rights during the transition from the exploration stage to the production stage					✓						✓
Know the process of liquidation and conservation of subsoil use objects			✓							✓	

PET414 - Drilling solutions
CREDIT - 5 (2/0/1/2)
PRE-REQUISIT – PET112 Fluid and Gas Mechanics

AIM AND OBJECTIVES OF THE COURSE

The purpose of studying the discipline is to convey to students the knowledge about drilling and grouting fluids as polydisperse heterogeneous systems obeying the basic laws of colloidal chemistry - the science of surface phenomena in dispersed systems. As a result of studying the discipline, the student must acquire knowledge: about the role of flushing and plugging in drilling and completing wells; on the composition, characteristic properties, areas of application of various types of drilling and grouting fluids, on methods of regulating drilling and grouting fluids, as well as materials used for this purpose.

BRIEF DESCRIPTION OF THE COURSE

The discipline includes topics such as the classification of drilling fluids, the main technological properties of drilling fluids, grouting fluids and cement stone, the influence of chemical treatment and external factors on the properties of drilling fluids, methods of property management, the choice of the density of drilling fluids, the preparation of programs and technological regulations, the circulation system, preparation and cleaning of drilling fluids.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Know the basic technological properties of drilling fluids, grouting fluids and cement stone				✓		✓					✓
Measure the main parameters of flushing fluids and cement slurries			✓				✓				
Own methods for determining and regulating the main technological parameters of flushing and grouting solutions					✓			✓			
Develop a complete description of the properties of clay rocks, polymer reagents and aqueous solutions		✓		✓							
Understand the properties of the interface and analyze their influence on the physicochemical processes in the well.			✓	✓				✓			
Combine the kinetics of cement hydration and hardening to analyze and examine well data.		✓				✓					
Know structure formation in drilling and grouting fluids	✓							✓			✓
Assess the effect of chemical treatment and external factors on the properties of drilling fluids					✓						✓
To select the optimal density of drilling fluids during the preparation and cleaning of drilling fluids.		✓		✓						✓	

PET420 – Natural gas and engineering
CREDIT - 5 (2/0/1/2)
PREREQUISIT – PET133 Thermodynamics and Heat Engineering

AIM AND OBJECTIVES OF THE COURSE
Teaching students the theoretical foundations of the development of gas and gas condensate wells. To give not only knowledge, but also to teach to think, analyze.

BRIEF DESCRIPTION OF THE COURSE
The discipline touches upon the foundations of the theory of design and development of gas and gas condensate fields, the development of a program of technological measures to improve the system of field development (deposits).

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the discipline, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Know the sources of reservoir energy and modes of development of gas and gas condensate fields	✓	✓									✓
Understand the features of the manifestation and characteristics of the drainage regimes of gas deposits	✓	✓									✓
Develop a mathematical description of the process of filtration of fluids in porous media under different development modes		✓									
Understand the basic principles of building a development system by field area			✓					✓			
To develop methodological principles for calculating technological indicators of the development of gas and gas condensate deposits under various conditions (with and without impact on productive formations)	✓	✓							✓		
Know the mechanism of physical and hydrodynamic, physicochemical, thermal, wave and other effects on productive formations in order to increase gas recovery and condensate	✓	✓						✓			✓

Understand the properties and composition of chemicals used in various technologies for gas and condensate production.			✓	✓	✓						✓
Describe some of the current issues and how they affect reservoir management or the oil industry in general										✓	
Recognize the mechanism of the filtration process of formation fluids for the conditions of a particular field (reservoir)			✓					✓			
Interpret problematic issues of the gas and condensate extraction process according to the actual indicators of the field (reservoir) development;							✓				✓
Apply in practice engineering calculation methods, assessing the effectiveness of elements of the development system					✓						✓
Develop a program of technological measures to improve the field development system (deposits)		✓					✓				
Assess the effectiveness of geological and technological activities carried out at the field (deposit)				✓				✓	✓		
Have the skills to use the accumulated experience in the development of gas and gas condensate fields			✓					✓			
Know the methodology of engineering calculations of technological indicators for the development of gas and gas condensate fields (deposits)				✓							✓
Possess the basics of solving scientific problems and interpreting information on the state of development of a gas and gas condensate field (deposit)		✓								✓	

PET427 - Design and operation of gas and oil pipelines
CREDITS – 3 (1/0/2)
PRE-REQUISIT - no

AIMS AND OBJECTIVES OF THE COURSE

The main purpose of studying the discipline is to acquire basic skills in the design and operation of storage facilities, gas stations, gas networks, the construction and repair of gas and oil pipelines and gas and oil storage facilities, the basics of technical diagnostics of oil and gas transport and storage facilities.

SHORT DESCRIPTION OF THE COURSE

The discipline examines the main issues of pipeline transport of liquid and gaseous hydrocarbons, provides a classification of pipelines and its main facilities, the essence of technological processes associated with pumping oil and gas through main pipelines, as well as the sequence of technological calculations of main pipelines. The main topics of the course are: Hydraulic calculation of an oil pipeline. Calculation of complex pipelines. Determination of the optimal frequency of pipeline cleaning; Peculiarities of pumping high-viscosity and highly solidifying oils. Determination of the conditions for the removal of gas and water from the main oil pipelines. Calculation of the bearing capacity of pipelines; Cleaning the internal cavity and testing of main oil pipelines for strength and tightness, Underwater crossings of oil pipelines; Stability of lifting pipelines; Calculations of longitudinal displacements of underground pipelines.

KNOWLEDGE, ABILITY, SKILLS AFTER COMPLETION OF THE COURSE

Matrix course outcomes - student outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Know the classification and purpose of pipelines	✓	✓				✓					
Make calculations to determine the wall thickness of pipelines.	✓	✓						✓			
Develop a plan for quality control of the construction of trunk pipelines				✓			✓				
Determine the cross-over points of gas and oil pipelines, the required number of oil pumping stations				✓				✓			✓
Understand the features of sequential pumping of oil and oil products				✓							✓
Understand the features of high-viscosity and highly solidifying oils	✓	✓							✓		
Predict and optimize pipeline performance using modeling and uncertainty estimates.			✓						✓		
Evaluate the state of the internal cavity and pipeline transitions										✓	
Apply knowledge, modern methods and design software for the preparation of design and working and technological documentation of objects of gathering, preparation, transportation and storage of oil and gas	✓										✓
The main approaches to the design of systems of field and main pipelines, main and auxiliary equipment	✓			✓							
Perform simple hydraulic calculations and other pipeline calculations using specialized modern technologies	✓										
Distinguish algorithms for solving problems of calculating simple and complex pipelines			✓		✓						
Optimization of design parameters of main pipelines							✓				✓

The procedure for the technological calculation of the main gas and oil pipelines, cleaning the cavity of the main pipelines. Determination of the nominal wall thickness of pipes.	✓							✓			
Possesses the basic provisions for the sequential pumping of oil and oil products. Protection of pipelines against pressure overloads and corrosion.		✓	✓								
Apply standard technical solutions for the design of gas and oil pipelines.	✓						✓				
Calculate the strength of pipelines	✓										

PET437 - Well stimulation techniques
CREDIT - 5 (2/0/1/2)
PREQUISIT - PET134 Technology and technology of oil production

PURPOSE AND OBJECTIVES OF THE COURSE

Formation of basic knowledge among students about the processes occurring in the bottomhole formation zone in the process of developing hydrocarbon reserves, technologies for stimulating the inflow.

SHORT DESCRIPTION OF THE COURSE

Technique and technology of impact on the bottomhole formation zone in order to stimulate the flow into a single well. Reasons for the decrease in the bottomhole zone permeability. Classification of methods of action. Fundamentals of the application of rock mechanics for solving problems of oil production technology. Hydraulic fracturing, hydrochloric acid treatment, fracturing modeling and diagnostics, hydrochloric acid treatment of terrigenous rocks, sand control, and wellbore stability. Review of current improvements and research.

KNOWLEDGE, ABILITY, SKILLS TO BE OBTAINED WITHIN THE COURSE

Matrix of course outcomes student results

Course outcomes	**Criterion 3. Students results**										
Upon completion of the course students must be able to…	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Explain the basic geological properties of rocks for the purpose of stimulation	✓	✓									✓

Assess the deterioration of reservoir properties, explain how and why this happens	✓	✓									
Define non-acidic ways to control formation damage	✓							✓			
Demonstrate the goals, types and basic principles of hydrochloric acid treatment								✓		✓	
Distinguish acid placement methods and explain pressure diagrams				✓						✓	✓
Explain quality control and safe working practices		✓			✓						✓
List and explain frac materials, their importance, including gels and water based reagents		✓			✓						
Apply fracturing graphs		✓						✓			
Explain quality and safety control of hydraulic fracturing				✓			✓	✓			

PET433 - Flow assurance
CREDIT - 3 (2/0/1)
PRE-REQUISIT - no

PURPOSE AND OBJECTIVES OF THE COURSE

The aim of this course is to provide students with practical skills in solving problems with ensuring an uninterrupted flow of oil and gas.

SHORT DESCRIPTION OF THE COURSE

There are many challenges in transporting oil and gas through pipelines. These challenges require a real understanding of the fundamentals of fluid mechanics, heat transfer, phase change, sedimentation and / or obstruction, erosion, and new technologies to ensure reliable and cost-effective oil and gas supply. Deep water production, heavy oils, high water quality, severe clogging, hydrates, acid gases, asphaltenes and waxes make this task even more difficult. This course will provide detailed explanations of topics, a well-balanced set of tutorials with real-life examples, inviting lecture from experienced engineers and training on specific flow software.

KNOWLEDGE, ABILITY, SKILLS TO BE OBTAINED WITHIN THE COURSE

Matrix of course outcomes vs student results

Course outcomes	Criterion 3. Students results

Upon completion of the course students must be able to…	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Identify the components of a complete flow study and explain how they relate to the design and operation of the supply chain	✓	✓									✓
Interpret and use the results of sampling and laboratory tests of formation fluids related to the provision of oil and gas flows		✓			✓						
Explain the basic properties of reservoir fluids and how they are modeled for a production and transportation system				✓				✓			
Evaluate and compare methods for the control and elimination of gas hydrates, paraffins, asphaltenes, emulsions, oil, corrosive, erosive and solids, and plugs	✓			✓				✓			
Explain the elements of a health report for subsea production facilities, branch lines and export flows				✓				✓			

PET431 - Reservoir engineering III: reservoir simulation
CREDIT - 3 (2/0/1)
PRE-REQUISIT - PET125 - Reservoir Engineering II: Secondary and tertiary recovery

PURPOSE AND OBJECTIVES OF THE COURSE
Formation of students' knowledge of the basics of hydrodynamic modeling of oil and gas reservoirs in the aspect of practical application in professional activities.

SHORT DESCRIPTION OF THE COURSE
This course covers the study of the fundamental principles of modeling oil and gas deposits, starting with the continuity equation, the Darcy equation, ending with a two-phase two-dimensional reservoir model. Students learn not only to use commercial reservoir modeling software, but also to create their own simple models.

KNOWLEDGE, ABILITY, SKILLS TO BE OBTAINED WITHIN THE COURSE

Matrix of course outcomes vs student results

Course outcomes	Criterion 3. Students results										
Upon completion of the course students must be able to…	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**

Explain the basics of reservoir modeling - the basic equations and numerical methods used to solve them.	✓										
Develop a simulation model of the reservoir, build a data set, execute the code for the simulator and visually view the simulation results using post-processing software.	✓				✓						✓
Plan and calibrate the reservoir simulation model.	✓		✓		✓						✓
Predict and optimize future characteristics of oil systems using reservoir modeling and economic models.	✓		✓		✓						✓
Apply reservoir modeling technology to solve production and development problems in individual wells or a system of wells.	✓				✓						✓
Apply reservoir modeling technology to solve production and development problems at all fields	✓				✓						✓
Effectively present the results of the engineering study in a written report.							✓				

PET432 Directional drilling
CREDITS – 5 (2/0/1/2)
PREREQUISIT – PET101 Drilling of oil and gas wells

AIM AND OBJECTIVES OF THE COURSE

The purpose of teaching this discipline is to convey to students information about new technical and technological means of multilateral and horizontally branched drilling of oil and gas wells, means and methods of designing their profiles, technology of keeping wells on a given trajectory.

BRIEF DESCRIPTION OF THE COURSE

The study of the discipline makes it clear how to drill layers of rocks and mineral deposits in the most favorable direction, avoid laying inclined wells and drilling vertically inclined wells along a rational profile, makes it possible to undercut mineral deposits at several points from the wellbore, i.e. drill multilateral wells.

KNOWLEDGE, ABILITY, SKILLS UPON COMPLETION OF THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	Student Outcomes

Upon completion of the course, students should be able to ...	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Make the necessary calculations	✓										
Interpret TVD, polar and rectangular coordinates and vertical section	✓	✓			✓						
Interpret the severity of the problem associated with the degree of deviation of the wellbore		✓			✓				✓		
Design 2D directional wells					✓			✓	✓		
Design horizontal wells					✓			✓	✓		
Determine the best completions for such wells					✓			✓			
Determine deflection and non-magnetic selection of drill collars		✓			✓						
Directional drilling with rotary BHA, jetting, fenders, motors, motor driven and rotary steerable systems	✓		✓					✓			✓
Underbalanced horizontal well drilling	✓		✓					✓			
Interpret the torque and weight on the hook, determine which factors will affect the torque and weight		✓			✓				✓		
Define cementing requirements for directional wells		✓						✓			

PET434 - Design and operation of gas and oil storages
CREDIT - 5 (1/0/2/2)
PRE-REQUISIT – PET172 - Design and operation of pumping and compressor stations

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PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of studying the discipline is the acquisition by students of the skills of calculating oil depots and equipment, the reliability and efficiency of the operation of all structures of gas and oil storage facilities, the development and implementation of measures to reduce oil losses.

SHORT DESCRIPTION OF THE COURSE

Underground and above ground reservoirs. Foundation and base of tanks. When choosing sites for the placement of tanks, take into account: the quality and condition of the soils underlying the site; climatic and seismic conditions of the area; the flow regime of groundwater, their chemical composition, as well as the permissible loads on the soil and the type of foundation, which must be established for each case after careful analysis. Classification of tank farms. The main structures of the oil depots. Nomenclature of domestic steel tanks. Tank specifications Vertical isothermal tanks. Axisymmetric drop-shaped reservoirs. Horizontal tanks. Technical and economic indicators. Losses of oil and oil products during the operation of tank farms. General procedure for the repair of tanks at oil depots. Determination of the volume of the tank farm and the choice of types of tanks.

KNOWLEDGE, ABILITY, SKILLS TO BE OBTAINED WITHIN THE COURSE

Matrix of course outcomes vs student results

Course outcomes	**Criterion 3. Students results**										
Upon completion of the course students must be able to…	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Explain the conditions and modes of operation and gas and oil storage facilities used for the construction of facilities for the oil and gas production and processing industry, steel grades, and other building materials, as well as the main methods of calculation and design in accordance with the existing regulatory documentation					✓			✓			
Calculate the capacity of the tank farm of a tank farm, losses when filling transport tanks, select and use various pipeline materials depending on the existing loads and operating conditions of equipment and structures	✓				✓						
Recommend the method of hydraulic calculations of hydrodynamic systems				✓		✓					✓
Use economic parameters to substantiate the effectiveness of proposed projects and technological solutions			✓								✓

Choose rational modes of operation of gas and oil storage facilities				✓	✓						
Basic calculations and materials required in the design of gas and oil storage facilities	✓		✓								
Assess the normative, technical and legislative base of design systems and organizations for the construction of gas and oil pipelines and gas and oil storage facilities and the tasks of predicting their technical condition.			✓						✓	✓	

PET439 Artificial lift systems
CREDIT - 5 (1/1/1/2)
PRE-REQUISIT - PET125 - Reservoir Engineering II: Secondary and tertiary recovery

PURPOSE AND OBJECTIVES OF THE COURSE

The aim of this course is to provide students with a broader understanding and application of the concepts and skills of artificial lift systems and their design and selection.

SHORT DESCRIPTION OF THE COURSE

This class covers the following topics: an overview of artificial lift technologies; selection criteria for artificial lift systems; reservoir performance: inflow to outflow ratio; artificial lift screening; introduction to sucker rod pumping units, gas lift and ESP systems, design.

KNOWLEDGE, ABILITY, SKILLS TO BE OBTAINED WITHIN THE COURSE

Matrix of course outcomes vs student results

Course outcomes	**Criterion 3. Students results**										
Upon completion of the course students must be able to…	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Suggest rational methods of maximization of oil production using artificial lift systems	✓	✓									✓
Calculate baseline PVT properties and flow rate calculations associated with artificial lift	✓							✓			

Understand and apply the principles of multiphase flow in tubing and pipes		✓					✓				
Select a suitable artificial lift system by examining the drawdown potential of each method, capital and operating costs and production range and depth using each method; special problem solving, like sand / scale / deviation, etc. are discussed with each method	✓	✓								✓	
Show the components and accessories required for each system				✓				✓			
Explain best practices available to extend the life of equipment and installed artificial lift systems					✓			✓			✓
Apply basic design and analysis concepts			✓								✓
Design and use system features for challenging environments		✓	✓							✓	

PET442 - Well testing
CREDIT – 5 (2/1/0/2)
PREREQUISIT – PET124 Reservoir Engineering I. Primary Production

AIM AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form students' knowledge of the basic principles of well exploration, as well as the application of this knowledge in solving various tasks. This course is designed to improve students' self-study skills. Therefore, students should consciously allocate enough time and energy to read, understand and apply knowledge and skills in the classroom. Lectures will be held in the form of a discussion based on what students have learned and missed while working on tasks.

BRIEF DESCRIPTION OF THE COURSE

This course covers the study of physical principles, technology of implementation and methods of interpretation of the results of modern complex hydrodynamic tests of wells.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	Criterion 3. Students' results										
Upon completion of the discipline, studentsshould be able to …	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Describe terminology and generally accepted methods for quantifying and predicting well efficiency, in particular, skin, horizontal and vertical permeability, as well as fault zone and crack permeability.	✓				✓						✓
To develop the possibility of using diagnostic graphs to determine filtration modes and well drainage models		✓									✓
Apply testing of wells with variable pressure to determine the characteristics of the well and the formation, that is, skin, permeability, distance to the boundaries		✓									✓
Apply testing of wells with variable flow rate to determine the characteristics of the well and the formation, that is, skin, permeability, reservoir volume		✓									✓

PET440 Well workover
CREDITS – 5 (2/0/1/2)
PREREQUISIT – PET101 Petroleum Production Engineering

AIM AND OBJECTIVES OF THE COURSE

The main goal of the discipline is to form students' knowledge and skills in the field of well workover, the choice of optimal technical and technological solutions for carrying out workover in wells, technical characteristics of equipment, operating rules, the basics of well workover in the development of oil and gas fields..

BRIEF DESCRIPTION OF THE COURSE

Reasons for well shutdowns for underground repairs. Peculiarities of underground current repairs of wells in different modes of operation. Selection and justification of kill fluids. Equipment, units, tools and technical means for carrying out underground repairs. Assessment of the quality of the performed underground repairs. Types of work during underground workover of wells. Repairs associated withthe elimination of casing malfunctions, with the restoration of the integrity of the cement behind the casing. Isolation of water penetrating through a leaky cement ring. Isolation of

waters penetrating through disturbances in the production casing. Bottom water isolation in the presence of water coning. Isolation of flooded layers. Sidetracking and drilling of the second wellbore. Fishing work in wells andfishing tools. Elimination of wells. Safety precautions, protection of subsoil and the environment whenperforming work on underground current workover of wells.

KNOWLEDGE, ABILITY, SKILLS UPON COMPLETION OF THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Student Outcomes**										
Upon completion of the course, students should be able to ...	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Select tubing, packers, and flow control equipment		✓									✓
Assess / develop an appropriate reservoir containment strategy	✓									✓	✓
Identify key design considerations for vertical and deviated wells, horizontal, multilateral, high pressure / high temperature conditions.		✓			✓	✓					
Select the appropriate downhole treatment / equipment strategy			✓		✓						✓
Identify key features and applicability of key sand control parameters	✓		✓	✓							
Evaluate problems and remedial actions for clogging / skin reduction	✓		✓		✓			✓			

PET131 – Computer - aided design
CREDIT – 5 (2/0/1/2)
PRE-REQUISITE – AUT109 Process Management

PURPOSE AND OBJECTIVES OF THE COURSE

The acquisition of theoretical and practical knowledge by students on the basics of modern computer-aided design systems, getting an idea of CAD / CAE / CAM systems that are widely used in the world for the design of objects.

SHORT DESCRIPTION OF THE COURSE

This course covers solving problems associated with the development of innovative and efficient methods of hydrocarbon production, transportation and storage, as well as issues of modeling technological processes. The aim of the course is to develop the skills of using software products in undergraduate students, as well as to develop their scientific and experimental research skills. The course contains topics about theorems and similarity criteria, the method of dimensions, the basics of mathematical and computer modeling.

KNOWLEDGE, ABILITY, SKILLS TO BE OBTAINED WITHIN THE COURSE

Matrix of course outcomes vs student results

Course outcomes	**Criterion 3. Students results**										
Upon completion of the course students must be able to…	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Explain the methodology of scientific research using modern program-targeted complexes of physical and mathematical modeling	✓										
Show the main technological processes in the industry, algorithms and programming languages					✓					✓	
Use physical, mathematical and computer models of the investigated processes, phenomena and objects related to the professional sphere	✓									✓	✓
Create new methods of modeling and calculations required in the design of technological processes and technical devices in the oil and gas industry and improve them				✓						✓	✓
Develop models of design solutions for quality management in oil and gas production				✓				✓			
Conduct a multi-criteria assessment when optimizing technological processes, projects, the work of an oil and gas organization		✓		✓	✓						
Compare modern computer technology, master the skills of developing physical and mathematical models, methods of processing field information, software for performing						✓				✓	✓

technological calculations in modeling the processes of the oil and gas industry											

PET438 - Development of offshore fields
CREDITS – 5 (1/0/2/2)
PREREQUISIT – PET134 Technology and technology of oil production

AIM AND OBJECTIVES OF THE COURSE

The acquisition by students of theoretical and practical knowledge about the features of the development and operation of oil fields at sea, to have an idea of all technological processes associated with drilling, development and operation of wells at sea.

BRIEF DESCRIPTION OF THE COURSE

Principles for the development of offshore fields, taking into account the geological and industrial, technical and technological, transport, environmental and regulatory components. The study of the discipline will make it possible to familiarize bachelors with the stages of development of shelf fields, with the peculiarities of drafting project documents and the regulatory framework used in this case, with the features of technologies for operating offshore wells and increasing their potential production capacity, with the peculiarities of transporting offshore products and environmental aspects of the development of offshore fields, with taking into account foreign and domestic experience.

KNOWLEDGE, ABILITY, SKILLS UPON COMPLETION OF THE COURSE

Course Outcome Matrix - Student Outcomes

Course Outcomes	**Student Outcomes**										
Upon completion of the course, students should be able to ...	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Determine the stages of development of such deposits, the requirements for their geological and commercial exploration at the stages	✓										
Apply modern systems and technologies for the development of offshore fields, their capabilities and conditions for optimal use										✓	✓

Compare and analyze the main modern techniques and technologies of research (petrophysical, geophysical, hydrodynamic, etc.) wells and reservoirs, their interpretation; methods of forecasting technological and economic indicators of development		✓									
Explain the principles of geological and technological modeling of deposits, work with information databases for preparing technological calculations, substantiating design options and choosing a rational development option					✓		✓	✓			
Systematize, generalize and analyze geological and technological information for the design of the next stage of field development		✓								✓	✓
Justify and propose an effective system for the development of oil and gas deposits, taking into account the adopted general schemes and field development projects		✓		✓			✓				
Apply methods and techniques of analysis and design of development, formation and management of geological and field information bases, geological and technological modeling of development		✓						✓			
Demonstrate skills in drafting design documents for development (or their sections) using specialized software systems.		✓		✓			✓				

PET419 - Corrosion protection of oil and gas equipment
CREDITS – 5 (2/0/1/2)
PRE-REQUISIT - no

AIMS AND OBJECTIVES OF THE COURSE

Demonstrate the theoretical and practical training necessary for an independent assessment of the corrosive activity of the environment, the choice of construction materials and means of corrosion protection for equipment in the oil and gas complex; evaluate methods for determining the calculated corrosion processes; to adapt in practical terms the knowledge gained in solving technological problems using the knowledge of fundamental laws.

SHORT DESCRIPTION OF THE COURSE

Basic concepts and definitions of corrosion processes. Chemical corrosion of metals. Electrochemical corrosion of metals. Corrosion surveys. Insulation coatings for metal structures. Cathodic protection of underground metal structures. Protection of pipelines and tanks. Electric drainage protection of underground pipelines. Corrosion inhibitors.

KNOWLEDGE, ABILITY, SKILLS AFTER COMPLETION OF THE COURSE

Matrix course outcomes - student outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Understand the purpose and composition of the objects of the transport system, linear part, pumping and compressor stations, pumping modes, requirements for fulfilling pumping technological conditions.	✓	✓									✓
Know modern achievements in the field of automation and intellectualization of pumping technological processes, measurement principles	✓	✓									✓
Evaluate the safe values of the physical characteristics and operating modes of technological objects.		✓		✓					✓		
Work in monitoring and control systems at computerized workplaces in a team, in interaction with specialists of related professions using various information channels						✓					
Reduce the consequences of emerging deviations and manage risks.	✓				✓						✓
Produce and interpret estimation errors for calculating reservoir properties.	✓		✓								✓
Possess modern software, skills in managing technological processes using automated			✓					✓			✓
workstations, methods for assessing the consequences of engineering and organizational decisions											

PET421 - Reservoir geomechanics
CREDITS – 5 (2/0/1/2)
PRE-REQUISIT – PET101 Petroleum Production Engineering

AIMS AND OBJECTIVES OF THE COURSE

The discipline "Geomechanics" forms a general idea of the physical processes occurring in the earth's crust and rock masses during the development of minerals and forms the skills of independent choice of rational methods of conducting and controlling the physical processes of mining operations based on a comprehensive analysis of the geomechanical and mining conditions of field development.

SHORT DESCRIPTION OF THE COURSE

This class covers and answers the following questions: how the drilling, production and development activities affect the stress equilibrium in the oil and gas reservoir; how these changes in stress can create various problems; how can we drill wells safely; where to place horizontal wells for better production; how geomechanics plays a role in reservoir development. The discipline also makes an introduction to the methodology for calculating the stability of the borehole walls, building a 1D model of mechanical properties (MMC), analyzing complications and stability of the borehole walls.

KNOWLEDGE, ABILITY, SKILLS AFTER COMPLETION OF THE COURSE

Matrix course outcomes - student outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Understand the basic concepts of reservoir geomechanics			✓								✓
Apply well data to calculate reservoir and lithostatic pressures.			✓			✓				✓	
Build a summary map of complications on drilled wells.					✓						
Make calculations to determine the horizontal stress, the angle of internal friction and the coefficient of friction.	✓		✓			✓					
Assess the cumulative risks associated with wellbore stability		✓			✓						✓
Build and analyze stereographic columns to assess wellbore stability		✓				✓					
Predict and optimize well performance using well modeling and uncertainty estimates.		✓			✓						✓

PET423 - Geostatistica
CREDITS – 5 (2/0/1/2)
PRE-REQUISIT – no

AIMS AND OBJECTIVES OF THE COURSE

Preparation for research activities related to the study and numerical description of natural phenomena distributed in space. As a result of mastering this discipline, one should master the methods of geostatistics and acquire skills in working with software tools for analyzing and modeling spatial data when conducting research in the field of oil and gas.

SHORT DESCRIPTION OF THE COURSE

Introduction to Geostatistics. Regional (or spatial) variables. Quantification of the criterion for determining the source of errors in the assessment, the fundamental basis of the geostatic approach, the average value and variance of the assessment error. Calculation of the variogram, interpretation, linking the behavior of the variogram to physical causes (geology, selection). Deviations, covariance, Krieg volume and variance ratio. Distribution of variance and variance estimates / simple calculations in one and two dimensions. Assessment of global balance and off balance reserves. Optimal assessment and introduction to kriging.

KNOWLEDGE, ABILITY, SKILLS AFTER COMPLETION OF THE COURSE

Matrix course outcomes - student outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Understand the basic concepts of probability and univariate statistics; bi-directional statistics and spatial relationships; covariance and correlation; second order stationarity	✓	✓									✓
Apply semivariogram evaluation and modeling; spatial assessment and static reservoir modeling; simple and regular kriging; uncertainty analysis; evaluation versus conditional modeling; sequential gaussian simulation	✓	✓									✓
Develop a complete description of the hydrocarbon reservoir using geostatic and engineering methods.		✓		✓							✓
Given a complete reservoir description and well data, design, construct, execute and evaluate a reservoir simulation model.			✓	✓							✓

Combine geostatistical methods and geological information for the analysis and study of subsoil data.	✓	✓									✓
Produce and interpret estimation errors for calculating reservoir properties.	✓	✓									✓
Predict and optimize reservoir performance using reservoir simulation and uncertainty estimates.			✓	✓	✓						✓
Describe some of the current issues and how they affect reservoir management or the oil industry in general										✓	

PET428 - Design and operation of pump and compressor stations
CREDITS – 5 (1/0/2/2)
PREQUISIT - no

AIMS AND OBJECTIVES OF THE COURSE

The objectives of the discipline are to assimilate by students the basics of design and operation of pumping and compressor stations (pumps, fans and compressors) used in the technological chains of oil refining enterprises.

SHORT DESCRIPTION OF THE COURSE

Discipline to teach future specialists the technology and organization of the construction of the linear part of the main pipelines and the development of technological schemes for the installation of structures of buildings of compressor stations, NS, as well as the main and auxiliary technological equipment, engineering networks and technological pipelines, ensuring their safe operation and reliability for the standard service life and during construction and reconstruction.

KNOWLEDGE, ABILITY, SKILLS AFTER COMPLETION OF THE COURSE

Matrix course outcomes - student outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)

Know the economic, environmental, social and industrial safety issues of the oil and gas industry;		✓									✓
Understand the terms of the production process, production management systems; proposals for improving the efficiency of using resources (material, technical and labor)	✓						✓				
Develop a feasibility study for innovative solutions in professional activities			✓	✓							✓
To independently acquire and use new knowledge and skills in practice, including in new areas of knowledge that are not directly related to the field of activity; develop operational plans for all types of activities related to research, development, design, construction, implementation and management of technological processes and production in the field of construction, transportation and storage of hydrocarbons	✓				✓						✓
Possess program-targeted methods for solving scientific problems.	✓	✓				✓					✓

PET429 - Multiphase flow systems
CREDITS – 5 (1/0/2/2)
PREQUISIT - PET124 Reservoir Engineering I. Primary Production

AIMS AND OBJECTIVES OF THE COURSE

To acquaint students with the current state of the theory of multiphase flows. Get a general idea of the methods for calculating the characteristics of two-phase flows; Master the methodology of physical modeling of multiphase flows; Get information about the processes of transfer of multiphase flows.

SHORT DESCRIPTION OF THE COURSE

The discipline explains the formation of multiphase flows in horizontal, deviated and vertical wells and pipelines, methods of dynamic calculations, determination of technological parameters. General conservation laws, interphase conditions and constitutive relations. Multiphase flows in pipes, maps of flow regimes, concentration distributions, pressure drop.

KNOWLEDGE, ABILITY, SKILLS AFTER COMPLETION OF THE COURSE

Matrix course outcomes - student outcomes

Course Outcomes	**Criterion 3. Students' results**										
Upon completion of the course, students should be able to	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Understand the basic concepts of multiphase flow systems		✓					✓				✓
Apply empirical correlations to determine the technological parameters of the system during the transportation of gas-liquid flows	✓					✓					✓
Perform hydraulic calculations of multiphase flows in oil and gas transmission systems		✓		✓				✓			
Build a hydrodynamic model of multiphase flows to optimize field productivity			✓	✓							
Apply methods for performing dynamic calculations, programming the calculation modules of multiphase flow meters, constructing nomograms that allow taking into account the flow regime in analytical calculations.	✓	✓						✓			
Build a hydrodynamic model for well killing planning	✓	✓									✓
Predict and optimize well performance using reservoir simulation and uncertainty estimates.					✓						✓
To improve the existing methods of accounting for the flow regime for calculating interfacial friction, by introducing criteria that determine the flow regime of a multiphase system in a continuous setting, and calculating their relationship with the hydrodynamic action.		✓	✓			✓		✓		✓	

APPENDIX 1 – SPE COMPETENCE MATRIX

Competency Matrix for General Petroleum Engineering SPE Task Force on Minimal Competency			
TASK	**GENERAL KNOWLEDGE/SKILL**		
	MINIMUM COMPETENCE BREADTH	**MINIMUM COMPETENCE DEPTH**	**ABOVE MINIMUM COMPETENCE**
Understand and use petroleum engineering terminology.	Understand general terminology of all sub- disciplines.	Understand terminology specific to the sub-discipline.	Understand terminology in areas of expertise.
Identify and use relevant 22i9n3d4u2S/tsrPyEa-nd company design standards.	Identify what design standards exist in all sub- disciplines.	Understand and use conventional design standards specific to the subdiscipline.	Help create design standards as well as apply standards to nonconventional applications.
Maintain regulatory compliance.	Identify what regulatory bodies have jurisdiction and where to find documentation of the applicable regulations. Understand the essential rules relevant to the work project.	Complete necessary regulatory compliance permitting and reporting specific to the sub-discipline.	Work with regulators on rule changes and exceptions.
Identify and use technical software and informational databases.	Identify what technical software and informational databases exist in all sub- disciplines.	Understand and use conventional technical software and informational databases specific to the subdiscipline.	Help create technical software and informational databases as well as apply technical software and informational databases to nonconventional applications.

Use project management skills.	Understand the elements of project management (costing, scheduling, contracting, logistics, etc.).	Apply project management skills to projects within sub-discipline.	Apply project management skills in larger projects and across subdisciplines.
Understand and apply geoscience principles.	Understand geoscience principles (e.g., fracture gradients, well bore stability, pore pressure prediction).	Understand and apply geoscience principles within sub-discipline.	Apply geoscience principles across sub-disciplines.
Perform decision and risk analysis and contingency planning.	Understand decision and risk analysis concepts and the value of contingency planning.	Conduct risk assessments within subdiscipline and prepare contingency plans to manage risks.	Conduct risk assessments across subdisciplines for a project and prepare contingency plans.
Monitor operations and optimize performance.	Understand basic monitoring and optimization techniques. Carry out directed well optimization plans or programs.	Perform conventional operations monitoring and engineering design specific to a sub-discipline and make optimization recommendations.	Perform operations monitoring in areas of expertise or across subdisciplines and make recommendations to optimize system performance.
Evaluate economics of project.	Understand basic economic principles (PV analysis, lease vs. purchase, etc.).	Perform economic evaluations of projects within the sub-discipline.	Perform economic evaluations across sub- disciplines or in specialty areas within a sub-discipline.
Participate in a multidisciplinary/cultural team.	Understand the purposes and value of a multi-disciplinary/ cultural approach to a project.	Perform all the conventional duties of the sub-discipline team member.	Lead a multi-disciplinary/ cultural team and be able to perform the duties of two or more sub-disciplines.

Perform duties in ethical manner.	Demonstrate the ethical code of behavior for the general practice of engineering.	Demonstrate ethical behavior in subdiscipline.	Demonstrate ethical behavior and provide leadership in ethical behavior across disciplines.
Promote engineering professionalism.	Maintain membership in technical and professional societies and pursue professional license and/or certification.	Participate actively in technical and professional societies and obtain professional license and/or certification.	Encourage othersin industry to join and actively participate in technical and professional societies and to become licensed or certified.

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

Рецензент Аскар МУНАРА
Доктор геолого-минералогических наук (Франция)
Управляющий директор по планированию месторождений
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Рецензия на образовательную программу по специальности «5В070800-Нефтегазовое дело» для программы «Бакалавриат»

При разработке и формировании образовательной программы в дополнении к нормативным документам авторы также использовали материалы Международного общества инженеров нефтяников (Society of Petroleum Engineers). Они проанализировали образовательную программу, рекомендуемую данным обществом, матрицу по техническим знаниям для выпускников-инженеров и инструмент для управления компетенциями. Кроме того, были учтены критерии аккредитации и подтверждающие документы ABET (Accreditation Board for Engineering and Technology, Inc). Тем самым можно утверждать, что данная образовательная программа была разработана в полном соответствии с международными требованиями.

Основной целью образовательной программы является предоставление студентам необходимых знаний и навыков, соответствующие требованиям современной индустрии и ведущим нефтяным образовательным программам мира. Это наглядно отражено в представленной таблице №1 (Основной критерий 3. Результаты студентов). Кроме того, необходимо отметить, что авторами разработки в качестве примера представлены критерий нефтяного факультета Колорадской горной школы.

Авторы также предоставили перечень дисциплин, рекомендованных Международным обществом инженеров нефтяников и учебный план Казахского национального исследовательского технического университета (КазНИТУ). Таким образом, можно наглядно увидеть, каким образом данная образовательная программа уже используется в КазНИТУ.

В завершении, авторы представили краткое описание каждого курса и какие результаты необходимы показать студентам в конце курса согласно критериям ABET.

Я, как специалист данной отрасли, руководивший проектом создания Школы горного дела и Института наук о Земле АОО «Назарбаев Университет» совместно с Колорадской Горной Школой в течение 2 лет, подтверждаю использование лучшей мировой практики в данной разработке. При этом, данная программа гармонично дополняет опыт и знания казахстанских ученых и инженеров, накопленные за время многолетней практики.

Я рекомендую данную образовательную программу, поскольку в ее разработке использовались лучшие мировые практики.

С уважением,

Др. Аскар МУНАРА **Астана / Декабрь 2017**

СӘТБАЕВ УНИВЕРСИТЕТІ 1934 SATBAYEV UNIVERSITY

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РЕЦЕНЗИЯ

на образовательную программу по специальности 5В070800 – Нефтегазовое дело, уровень программы «Бакалавриат», разработанная коллективом преподавателей кафедры Нефтяная инженерия Института геологии и нефтегазового дела Казахского национального исследовательского технического университета им. К.И. Сатпаева .

Образовательная программа (далее ОП) представляет собой систему документов, разработанную на основе государственного образовательного стандарта РК.

Рецензируемая программа включает: основные определения, цели ОП, используемые нормативные документы, общие положения, учебный план. ОП регламентирует цели, тесно связанные с миссией программы, кафедры и университета, ориентированные на профессиональные компетенции, а также выполнение этической, социальной и экологической ответственности студента.

Стратегической целью ОП является подготовка высококвалифицированных специалистов, обладающих высоким уровнем компетентности, всесторонне развитых, обладающих широкими техническими знаниями и умственными навыками, успешных профессионалов на ранней стадии карьеры.

ОП относится к критерию ABET, как к престижной и рекомендуемой аккредитации, а именно к критерию Результаты студентов, основные из которых перечислены в ОП. Модуль учебного плана разработан на базе рекомендаций Сообщества Инженеров Нефтяников, что является большим преимуществом при формировании дисциплин, которые по своему содержанию позволяют обеспечить компетенции выпускника. Качество содержательной составляющей учебного плана не вызывает сомнений. Включенные в план дисциплины раскрывают сущность актуальных на сегодняшний день инженерных проблем.

В разделе «Описание курса» приводится краткое описание и результаты курсов, а также их соответствие критериям ABET. Результаты курсов ориентированы не только на знание и понимание дисциплины (1 и 2 уровень Таксономии Блума), но также на применение изученного материала на практике, а также при изучении новой темы, а также анализ (3 и 4 уровень Таксономии Блума).

Содержание курса «Многодисциплинарный нефтегазовый проект» позволяет подытожить полученные знания и компетенции студента и интегрировать их для решения реальных задач, что обеспечивает формирование практических навыков студентов.

Написание и защита дипломного проекта заключается в сборе информации, проведении расчетов, анализе данных, обобщении результатов, приведении выводов с последующими рекомендациями для исследования и определении значимости, области применения исследования и потенциальной выгоды.

Разработанная ОП в полной мере соответствует заявленному уровню подготовки студента бакалавра. Предусмотренные дисциплины формируют высокий уровень компетенций.

С уважением,

Инженер по заканчиванию
Weatherford.

Бэйбит Джуманов

Prepare
Engine

DR. ERDAL OZKAN
DEPARTMENT HEAD
PETROLEUM ENGINEERING

Murat Syzdykov
Head of Petroleum Engineering Department
Satbayev University
Almaty, Kazakhstan

Jan. 11, 2018

Re: Assessment of the Petroleum Engineering Program at Satbayev University

Dear Murat,

As per your request, this letter provides my assessment of the quality indicators of the Petroleum Engineering Department at the Satbayev University and my recommendations to improve the strength of the program. My assessment is a result of my experience and knowledge about similar programs in the U.S. and around the world.

I am currently the Head of the Petroleum Engineering Department at the Colorado School of Mines, which is one of the oldest and leading petroleum engineering programs in the U.S. I have had the opportunity to learn about your program through my involvement in the project supported by the World Economic Forum and a consortium of international oil companies aiming at the improvement of your Department's capabilities to provide the competent workforce for the Kazakh oil industry. I visited your Department twice in the past year and also served as the Chair of your Department's Industry Advisory Board. Additionally, I served as the Chair of the U.S. Petroleum Engineering Department Heads Association between 2016 and 2018, which provided me with extensive references to be used in my following assessment.

The Petroleum Engineering Department at the Satbayev University has a long history (since 1966) and a large group of alumni (over 10,000 graduates) serving in the oil and natural gas industry of Kazakhstan and around the world. In Summer 2018, 248 undergraduate and 8 graduate students graduated from the program. The surveys run by the Department indicate that the students are reasonable happy with the program There is no doubt that the program has been fulfilling an important mission in national education and successfully serving the national oil and gas industry.

Since 2016, there has been a major curriculum modernization effort and the current undergraduate program flowchart is similar to those typically followed by the Colorado School of Mines and most other U.S. institutions. Moreover, the course contents and instructional materials are primarily the same as those used in the other petroleum engineering programs around the world. The program has 27 faculty members, which is a reasonably large number compared to the peer universities in the U.S. However, providing the lectures in three languages increases the faculty workload disproportionately. Besides, the faculty is an eclectic group with diverse educational backgrounds, different levels of experience, and dissimilar preparation and career expectations. This is likely to cause discrepancies in teaching styles and contents of the course material. Currently, the heavy teaching load of the faculty does not leave any time for faculty development and research, nor is it expected to contribute to the motivation of the faculty. However, during an interview by the Industry Advisory Board members, the students

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were very appreciative of the faculty making themselves available during and outside their office hours, in person, by e-mail, or by telephone.

A shortcoming of the program is insufficient lab facilities to teach a modern PE curriculum and to run a strong research program. There has been some research activity and funding (currently, ~$240K) in collaboration with some foreign universities. However, the lack of strong industry connections and deficiencies in the research infrastructure impairs the ability of the faculty to attract larger research funding.

In light of the above observations, to improve the strength of the Department, more emphasis on faculty development is recommended. Faculty workload should be managed to improve the faculty performance and instructional quality. Particularly, the teaching load of the junior faculty needs to be reduced to provide them with the opportunity to learn, improve, establish, and sharpen their skills. Also, a master plan is necessary to improve the teaching and research equipment, facility (physical space), maintenance, and technician needs of the program to be able to teach modern PE course contents and to perform research.

Should you have any questions about this assessment, please do not hesitate to contact me.

Sincerely,

Erdal Ozkan

Dr. Erdal Ozkan
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