



Національний технічний університет України  
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ  
імені ІГОРЯ СІКОРСЬКОГО»



Machines and devices of  
chemical and oil refining  
industries

# PRIMARY GAS AND OIL REFINING PROCESSES AND TECHNOLOGIES

## Working program of the academic discipline (Syllabus)

### Details of the academic discipline

Level of higher education	<i>First (undergraduate)</i>
Branch of knowledge	<i>13 Mechanical engineering</i>
Specialty	<i>133 Industrial engineering</i>
Educational program	<i>Computer-integrated technologies of chemical engineering equipment design</i>
Discipline status	<i>Selective</i>
Form of education	<i>daytime</i>
Year of training, semester	<i>1st year, spring semester</i>
Scope of the discipline	<i>4 credits</i>
Semester control/ control measures	<i>Assessment, MKR, essay</i>
Lessons schedule	<i><a href="http://rozkklad.kpi.ua/Schedules/ScheduleGroupSelection.aspx">http://rozkklad.kpi.ua/Schedules/ScheduleGroupSelection.aspx</a></i>
Language of teaching	<i>Ukrainian</i>
Information about head of the course / teachers	<i>Lecturer/Practical: associate professor of the Department of the National Academy of Sciences of the Russian Academy of Sciences, candidate of technical sciences, Associate Professor A.R. Stepanyuk, &lt; arstepaniuk@gmail.com &gt;</i>
Placement of the course	<i><a href="https://ci.kpi.ua/uk/syllabuses-bac-disciplines/#place">https://ci.kpi.ua/uk/syllabuses-bac-disciplines/#place</a></i>

### Program of educational discipline

*Description of the educational discipline, its purpose, subject of study and learning outcomes*

*The purpose of the educational discipline.*

*The purpose of the educational discipline is to form students' competence:*

The purpose of the educational discipline is to form students' competence:

- *Ability to generate new ideas (creativity).*
- *Ability to think systematically.*
- *Ability to achieve set goals.*
- *The ability to take initiative and a creative approach when solving tasks.*
- *The ability to express one's point of view in a reasoned, convincing and understandable way.*
- *Ability to apply typical analytical methods, quantitative methods of mathematics, physics, engineering sciences, as well as computer software tools for effective solving of chemical engineering problems.*
- *Ability to apply fundamental scientific facts, concepts, theories, principles to solve professional tasks and practical problems in chemical engineering.*
- *The ability to evaluate and ensure the quality of the work performed.*
- *Ability to use computerized design systems and specialized application software to solve problems in chemical engineering*

*1.2. The main tasks of the academic discipline.*

*After mastering the academic discipline, students must demonstrate the following learning outcomes:*

- Apply computer systems and software for working with texts and their illustrations, data processing and calculations.
- To know and understand the principles, approaches and methods of engineering equipment of chemical and related technologies and the prospects of their development, to be able to analyze engineering objects, processes and methods.
- Be able to make creative decisions when designing, develop new and improve known elements of technological equipment.
- Know the basic methods and be able to perform variant calculations of equipment and technological modes of its operation with the use of computer systems and specialized software, taking into account the laws of flow of processes of chemical and related technologies when justifying decisions made regarding the development, modernization and operation of equipment throughout the entire life cycle, and as well as disposal of by-products and waste.

## **1. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)**

*The list of disciplines, the mastery of which is necessary for the student (requirements for the level of preparation) for successful mastering of the discipline:*

- Theoretical foundations of heat engineering.
- Processes and equipment of chemical technologies

*the list of disciplines that are based on the results of training in this discipline.:*

- Processes and equipment of chemical technology-4. Mass exchange processes
- Pre-diploma practice
- Diploma design
- Basics of three-dimensional design
- Installation, operation and repair of chemical and oil refinery equipment
- Heat treatment technologies

## **2. Content of the academic discipline**

### **Chapter 1. General information about oil.**

*Topic 1.1 General information about oil.*

*Introduction. The purpose and tasks of the course are given. The origin and conditions of oil deposits, oil and gas reserves, the main oil and gas-bearing areas are analyzed. Analysis of oil reserves, analysis of the geopolitical state of the modern world is carried out.*

*Topic 1.2. Chemical and physical composition of oil.*

*The chemical composition of oil is analyzed. The physical properties of oil and oil products, the properties of oil and distillates are analyzed. The properties of oil from different fields are analyzed.*

*Topic 1.3. Methods of analysis, classification of oil and oil products.*

*Methods of analysis, classification of oil and oil products are given. The classification of oil properties of different fields is substantiated.*

*Topic 1.4. Products of primary and deep oil processing.*

*The products of primary and deep oil processing and the dependence of product quality on the quality of raw materials are analyzed.*

### **Chapter 2. Oil production.**

*Topic 2.1. Exploration of oil fields, drilling of wells, extraction of oil from the ground.*

*The methods of exploration of oil and gas fields are substantiated. Prospects for the development of production and resources for increasing oil and gas production are analyzed. Prospects for oil production are analyzed depending on its properties and the region where the deposits are located.*

*Topic 2.2. Collection and preparation of oil at oil fields.*

*The methods of oil extraction are substantiated. Preparation of oil fields. Transportation of oil to the wellhead. Methods and methods of oil preparation for transportation, transportation methods are analyzed. Oil fields and methods of oil production are analyzed. Methods of oil preparation are analyzed depending on the properties of oil from different deposits.*

### **Chapter 3. Primary oil processing.**

#### *Topic 3.1. Oil refining processes.*

*The main processes of oil processing are substantiated. The classification of processes is given. Modern processes of oil product processing in Ukraine are analyzed.*

#### *Topic 3.2. The main refineries of Ukraine and their features*

*The main schemes of oil refineries are analyzed. The classification of factories is given. The raw materials and products of the refinery are substantiated. Schemes of oil processing plants are analyzed depending on the needs of the economy and the properties of oil from different deposits.*

#### *Topic 3.3. Properties of fuels and lubricants.*

*The properties of fuels and lubricants (octane number, cetane number) are substantiated. Fuel and lubricant standards are given and analyzed. Fuels and their properties produced in Ukraine are analyzed.*

#### *Topic 3.4. Desalination and dehydration processes.*

*The processes of desalination and dehydration, electrodehydration, separation are analyzed. Schemes of these processes are analyzed. Types and types of desalination and dehydration plants are analyzed.*

#### *Topic 3.5. Processes of primary oil processing.*

*Primary oil processing is analyzed. Theoretical bases and types of installations are analyzed. Simple and complex distillation, steam distillation and dilution are analyzed. The types and types of primary oil processing units are analyzed depending on their properties.*

#### *Topic 3.6. Multicomponent rectification.*

*Multicomponent rectification is analyzed. Basic laws and concepts are given. The calculation algorithm of the fractionating rectification column is presented. Types and types of rectification columns are analyzed. The method of sizing the elements of the fractionating rectification column is given.*

### **3. Educational materials and resources**

#### **5.1 Basic**

1. *Processes of primary gas and oil processing [Electronic resource]: study guide / NTUU "KPI"; structure. A. R. Stepaniuk. – Electronic text data (1 file: 291 MB). - Kyiv: NTUU "KPI", 2013. - 126 p. – Title from the screen. – Access:<http://ela.kpi.ua/handle/123456789/2686>*
2. *Kuznetsov A.A., Kagermanov S.M., Sudakov E.I. Calculations of processes and devices of the oil refining industry. Ed. 2nd trans. and additional L., "Chemistry", 1974. 344 p.*
3. *Calculation method of heat exchange devices for oil refining industries [Electronic resource]: study guide for students studying in the direction of "Mechanical engineering" specialty "Equipment of chemical industries and building materials enterprises" / NTUU "KPI" ; structure. L. G. Voronin, A. R. Stepaniuk, L. I. Ruzhynska. - Electronic text data (1 file: 1.82 MB). - Kyiv: NTUU "KPI", 2010. - 68 p. - Title from the screen. - Access from the university network:<http://service.library.ntu-kpi.kiev.ua/documents/E9-10-289.pdf>*
4. *Shved M.P., Stepaniuk A.R. Irrigation heat exchanger calculation algorithm [Text]: method. instructions for practice. work for students special "Equipment of chemical production and building materials enterprises" K.: NTUU "KPI" VPI Military Industrial Complex "Polytechnic". 2008. 16 c.*

#### 4. Methods of mastering an educational discipline (educational component)

##### Lecture classes

Lectures are aimed at:

- provision of modern, comprehensive in-depth knowledge of the discipline, the level of which is determined by the target attitude to each specific topic;
- provision of critical creative work together with the teacher in the process of work;
- education of acquirers of professional qualities and development of their independent creative thinking;
- awareness of global trends in the development of science in the field of processes and technology of primary gas and oil processing;
- awareness of the methods of processing information resources and determining the main directions for solving specific scientific and technical problems;
- teaching research materials in a clear and high-quality language in compliance with structural and logical connections, clarification of all given terms and concepts available for perception by the audience.

No s/p	The name of the topic of the lecture and a list of the main questions (a list of didactic tools, references to the literature and tasks on the SRS)	Number hours
	<b>Chapter 1 General information about oil.</b>	
1	<b>Information about oil and gas. Origin of oil and gas. Classification of oils.</b> Introduction. The purpose and tasks of the course are given. Information about oil and gas is provided. The origin of oil and gas is analyzed. The classification of oils is given.	2
	literature[1, 2, 5, 6].	
	Task on SRS: Analysis of oil reserves.	
2	<b>World oil and gas reserves and major gas and oil-bearing areas. OPEC countries. Oil and gas price control.</b> The world oil and gas reserves and the main gas-bearing and oil-bearing regions are analyzed. OPEC countries are listed. Oil and gas price control is analyzed. The properties of oils and their components are analyzed.	2
	literature[1, 2, 5, 6].	
	Task on SRS: Analysis of new hypotheses of the origin of oil and gas. Analysis of the geopolitical state of the modern world.	
	<b>Chapter 2. Oil and gas extraction</b>	
3	<b>Oil and gas exploration. The scheme of the location of oil and gas deposits in the ground. Drilling wells</b> Methods and methods of oil and gas exploration are analyzed. The location schemes of oil and gas deposits in the ground are analyzed.	2
	literature[1, 2, 5, 6].	
	Tasks at SRS: Analysis of prospects for oil production depending on its properties and the region where the deposits are located.	
4	Well drilling methods are analyzed	2
	literature[1, 2, 5, 6].	
	Tasks at SRS: Analysis of prospects for oil production depending on its properties and the region where the deposits are located.	

5	<b>Extraction of oil from the ground. Collection and preparation of oil at oil fields. Transportation of oil</b> The methods of oil extraction are substantiated. Preparation of oil fields. Transportation of oil to the wellhead. Methods and methods of oil preparation for transportation, transportation methods are analyzed.	2
	literature[1, 2, 5, 6].	
	Tasks at SRS: Analysis of methods of deposits before oil extraction and methods of oil extraction.	
6	Oil fields and methods of oil production are analyzed. Methods of oil preparation are analyzed depending on the properties of oil from different deposits.	
	literature[1, 2, 5, 6].	
	Task at SRS: Analysis of oil preparation methods depending on the properties of oil from different deposits.	
	<b>Chapter 3. Composition and properties of oil and oil products</b>	
7	<b>Chemical composition and properties of oil. Group composition of oil. Classification of groups of compounds and their characteristics.</b> The chemical composition and properties of oil, the group composition of oil are analyzed.	2
	literature[1,2,3,5].	
	Task on SRS: Analysis of the properties of oil from different deposits.	
8	The classification of groups of compounds and their characteristics are substantiated.	2
	literature[1,2,3,5].	
9	<b>Physical properties of oil and oil products. Fractional composition of oil. Properties of gasoline, diesel fuel and lubricants</b> The physical properties of oil and oil products, properties of oil and distillates are analyzed.	2
	literature[1,2,3,5].	
	Task on SRS: Analysis of the properties of oil from different deposits.	
10	The properties of oil from different fields are analyzed. The properties of gasoline, diesel fuel and lubricants are analyzed.	2
	literature[1,2,3,5].	
	Task on SRS: Analysis of the properties of branded gasoline, diesel fuel and lubricants.	
	<b>Chapter 4. Primary oil processing</b>	
11	<b>Main oil refining enterprises of Ukraine. Schemes of oil refineries. Processes of primary oil processing</b> The main schemes of oil refineries are analyzed. The classification of factories is given. The raw materials and products of the refinery are substantiated.	2
	literature[1, 4, 5, 6, 8].	
	Task at SRS: Analysis of schemes of oil processing plants depending on the needs of the economy and the properties of oil from different deposits.	
12	Schemes of oil processing plants are analyzed depending on the needs of the economy and the properties of oil from different deposits.	
	literature[1, 4, 5, 6, 8].	
thirteen	<b>Preparation of oil for processing Desalination and dehydration of oil. Schemes of supply and determination of consumption of washing water. The processes of oil preparation for processing are analyzed. The processes of desalination and dehydration, electrodehydration, separation are analyzed.</b>	2
	literature[1, 4, 5, 6, 8].	
	Tasks at SRS: Analysis of types and types of desalination and dehydration plants.	



14	<i>Schemes of these processes are analyzed. Types and types of desalination and dehydration plants are analyzed.</i>	
	<i>literature[1, 4, 5, 6, 8].</i>	
15	<b>Primary oil processing. Products of primary oil processing. Distillation with gradual evaporation. Distillation with one-time (equilibrium) evaporation</b> <i>The processes of primary oil processing are analyzed. Theoretical bases and types of installations are analyzed.</i>	2
	<i>literature[1, 4, 5, 6, 8].</i>	
16	<i>Theoretical bases and types of installations are analyzed. Simple and complex distillation are analyzed. Distillation with water vapor and with dilution are analyzed.</i>	
	<i>literature[1, 4, 5, 6, 8].</i>	
17	<i>The types and types of primary oil processing units are analyzed depending on their properties.</i>	
	<i>literature[1, 4, 5, 6, 8].</i>	
	<i>Tasks at SRS: Analysis of types and types of primary oil processing installations depending on its properties.</i>	
18	<b>Test</b>	2

### Practical training

*Applicants should be helped to develop creative thinking, a creative approach to the scientific substantiation of the research direction and methodology. The main tasks of the cycle of practical classes:*

- help applicants to deepen their theoretical knowledge in the field of processes and technology of primary gas and oil refining;*
- to promote the training of miners in the methodology of determining the properties of oils and the peculiarities of their processing;*
- form criteria for evaluating the efficiency of primary gas and oil refining processes.*

<b>No s/p</b>	<b>The name of the subject of the practical session and a list of the main questions (list of didactic support, references to the literature and tasks on the SRS)</b>	<b>Number hours</b>
	<b>Chapter 3. Composition and properties of oil and oil products</b>	
1	<i>Chemical composition and properties of oil. Group composition of oil. Classification of groups of compounds and their characteristics.</i>	
	<i>Determination of thermophysical properties of oil fractions.</i>	2
	<i>Literature 1.</i>	
	<i>SRS: prepare the topic Chemical and physical composition of oil.</i>	
	<i>Literature 1-5</i>	
2	<i>Physical properties of oil and oil products. Fractional composition of oil.</i>	
	<i>Construction of acceleration curves. Determination of the number of fractions of petroleum products in oils</i>	2
	<i>Literature 1</i>	
	<i>SRS: prepare the topic Products of primary and deep oil processing.</i>	
	<i>Literature 1</i>	
3	<i>Calculation of a shell-and-tube heat exchanger for heating oil fractions</i>	4
	<i>Literature 1</i>	
	<i>SRS: prepare the topic Products of primary and deep oil processing.</i>	
	<i>Literature 1</i>	
4	<i>Calculation of an air heat exchanger for cooling oil fractions</i>	4
	<i>Literature 1</i>	

	<i>SRS: prepare the topic Products of primary and deep oil processing.</i>	
	<i>Literature 1</i>	
5	<i>Calculation of the steam generator of oil fractions</i>	4
	<i>Literature 1</i>	
	<i>SRS: prepare the topic Products of primary and deep oil processing.</i>	
	<i>Literature 1</i>	
	<b>Chapter 4. Primary oil processing</b>	
	<b>Main oil refining enterprises of Ukraine. Schemes of oil refineries. Processes of primary oil processing</b>	
6	<i>Calculate the vertical separator. Calculate the horizontal separator</i>	2
	<i>Literature 1</i>	
	<i>SRS: prepare Topic Processes of primary oil refining. Separators</i>	
	<i>Literature 1</i>	
	<i>Topic 4.2 Preparation of oil for processing</i>	
7	<i>Determining the amount of washing water for parallel and serial washing water supply schemes.</i>	2
	<i>Literature 1</i>	
	<i>SRS: prepare Topic Processes of desalination and dehydration. Oil washing process</i>	
	<i>Literature 1</i>	
	<i>Desalination and dehydration of oil. Schemes of supply and determination of consumption of washing water. Electrodehydrators. Demulsifiers</i>	
	<i>Perform a parametric calculation of the electrodehydrator. Perform a parametric calculation of a steam generator for the evaporation of hydrocarbon gases.</i>	2
	<i>Literature 1</i>	
	<i>SRS: prepare Topic Processes of desalination and dehydration. Electrodehydrators</i>	
	<i>Literature 1</i>	
	<i>Primary oil processing. Products of primary oil processing. Distillation with gradual evaporation. Distillation with one-time (equilibrium) evaporation</i>	
8	<i>Perform a parametric calculation of the evaporation column.</i>	4
	<i>Literature 1</i>	
	<i>SRS: prepare Topic Processes of primary oil refining. Steam installations</i>	
	<i>Literature 1</i>	
	<i>Perform a parametric calculation of the fractionating rectification column</i>	4
	<i>SRS: prepare a Topic. Gas fractionation. Separation of saturated and unsaturated hydrocarbon gases.</i>	
	<i>Literature 1</i>	
	<i>Topic 4.5 Calculation of one-time evaporation of a hydrocarbon mixture. Multiple evaporation. Distillation with dephlegmation. Distillation in a vacuum with steam. Combined installation of electric desalination and dehydration of oil.</i>	
9	<i>Modular control work.</i>	2
	<i>literature[1, 2, 5, 6].</i>	

## 5. Independent work of student

*Independent work makes up 50% of the study of the credit module, which includes preparation for the credit. The main task of independent workacquirers- this is the deepening of worldview and scientific knowledge in the directions specified in the lectures, through the search for necessary information, the formation of perseverance and creative search in the formation of working hypotheses for the intensification of transfer processes.*

## 6. Policy of academic discipline (educational component)

### Rules of attending classes and behavior in classes

Attending classes is mandatory. Getters are obliged to take an active part in the educational process, not to be late for classes and not to miss them without valid reasons, not to interfere with the teacher conducting classes and not to be distracted by actions unrelated to the educational process.

### Rules for assigning incentive and penalty points

- incentive points can be awarded by the teacher exclusively for the performance of creative works and working hypotheses.  
But their sum cannot exceed 25% of the rating scale.
- Penalty points are not provided within the academic discipline.

### Policy of deadlines and rescheduling

In case of academic debts arising from the academic discipline or any force majeure circumstances, acquirers should contact the teacher to coordinate the algorithm of actions related to solving existing problems.

### Policy of academic integrity

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Inadmissible tips and write-offs during writing tests, conducting classes.

The policy and principles of academic integrity are defined in Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

### Policy of academic behavior and ethics

Getters must be tolerant, respect the opinion of others, formulate objections in the correct form, adequately support feedback during classes.

Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

## 7. Types of control and rating system for evaluating learning outcomes (RSO)

Distribution of study time by types of classes and tasks in the discipline according to the working study plan:

Semester	Training time		Distribution of study hours				Control measures		
	Credits	Acad. hours	Lectures	Practical	Lab. do	SRS	MKR	RR	Semester control
8	4	120	36	18	—	66	1	1	test

### The student's rating in the discipline consists of the points he receives for:

The rating of the applicant from the credit module consists of the points he receives for work in practical classes, lectures and MKR.

Semester control is an exam.

### System of rating (weighted) points and evaluation criteria

System rating points and evaluation criteria:



*A weighted point for questions in lectures is 1 point*

*The weighted score for practical classes is 4 points each;*

*The weighted score for RR is 15 points*

*The weighted score for MKR is 15 points*

*The weighted score for the assessment is 21 points*

*Criteria for evaluating the performance of a practical task*

<b>Completeness and signs of task completion</b>	<b>Points</b>
<i>The task is fully completed</i>	<i>4</i>
<i>Minor defects according to point 1</i>	<i>3</i>
<i>Untimely completion of the task</i>	<i>2.5</i>
<i>Untimely completion of the task, deficiencies under clause 1</i>	<i>2</i>
<i>Poor performance of the task</i>	<i>1</i>
<i>Failure to complete the task</i>	<i>0</i>

*Thus, the rating semester scale from the credit module is:*

$$R = 17 \cdot 1 + 4 \cdot 8 + 1 \cdot 15 + 1 \cdot 15 + 1 \cdot 21 = 100 \text{ points}$$

*According to the results of the educational work in the first 7 weeks, the "ideal achiever" should score 40 points. At the first attestation (8th week), the applicant receives "passed" if his current rating is at least 20 points.*

*According to the results of the educational work for 13 weeks of training, the "ideal achiever" should score 90 points. At the second certification (14th week), the applicant receives "credited" if his current rating is at least 40 points.*

*The maximum number of points is 100. To receive credit from the credit module "automatically" you need to have a rating of at least 60 points.*

*A necessary condition for admission to credit is a rating of at least 40% of the rating scale (R), i.e. 40 points.*

*Getters, who scored a rating of less than 0.6 R during the semester, as well as those who want to improve the overall rating, complete a credit test. At the same time, all the points they received during the semester are cancelled. Test tasks contain questions that refer to different sections of the credit module. The list of assessment questions is given in Chapter 9.*

*To obtain a passing grade, the sum of all rating points R received during the semester is converted according to the table:*

<b>Scores</b>	<b>Rating</b>
<i>95...100</i>	<i>perfectly</i>
<i>85...94</i>	<i>very good</i>
<i>75...84</i>	<i>fine</i>
<i>65...74</i>	<i>satisfactorily</i>
<i>60...64</i>	<i>enough</i>
<i>RD &lt; 60</i>	<i>unsatisfactorily</i>
<i>Admission conditions not met</i>	<i>not allowed</i>

## **8. Additional information on the discipline (educational component)**

**An approximate list of questions submitted for semester control**

**The ticket consists of three questions, two questions from part 1 and a task from part 2.**

### **Part 1.**

1. Analyze the origin of oil. Hypotheses of the origin of oil.

2. Analyze the scheme of the drilling rig.
3. Analyze the classification of oils.
4. Analyze oil reserves and the main gas-bearing regions of the world.
5. Analyze construction schemes of oil extraction pumps from the field.
6. Analyze oil reserves and the main gas-bearing regions of the world.
7. Analyze oil reserves and the main gas-bearing regions of Ukraine.
8. Analyze means of removing oil from deposits
9. Analyze oil exploration methods.
10. Analyze construction schemes of oil extraction pumps from the field.
11. Analyze the physical properties of oil.
12. Detonation of gasoline, octane number. Motor and research method for determining the octane number.
13. Analyze the properties of automobile gasoline.
14. Analyze the chemical composition of oil
15. Analyze oil processing processes at refineries
16. Analyze means of removing oil from deposits
17. Analyze the classification of oils.
18. Analyze means of removing oil from deposits
19. Analyze schemes of primary oil processing
20. Analyze the physical properties of oil.
21. Analyze oil reserves and the main gas-bearing regions of the world.
22. Analyze the origin of oil. Hypotheses of the origin of oil.
23. Analyze oil reserves and the main gas-bearing regions of Ukraine.
24. Analyze construction schemes of oil extraction pumps from the field.
25. Analyze the physical properties of oil.
26. Analyze the origin of oil. Hypotheses of the origin of oil.
27. Analyze devices for removing oil from deposits
28. Analyze oil processing processes at oil refineries
29. Analyze construction schemes of oil extraction pumps from the field.

## Part 2.

You received 1000 tons of oil.

Required according to option # \_\_\_\_ (table 1) and # \_\_\_\_ (table 2):

1. Construct the acceleration curve for the specified oil
2. Determine the percentage of the fraction specified by the teacher in oil.
3. Determine the average relative density and the average density (for the average temperature) of the fraction of oil specified by the teacher for the liquid phase of the fraction;
4. Determine the average characteristic factor of the fraction indicated by the teacher;
5. Determine the specific average enthalpy of the fraction specified by the teacher;
6. Determine the average heat capacity (for the average temperature) of the oil fraction specified by the teacher for the liquid phase;
7. Determine the amount of energy that must be removed when cooling the fraction indicated by the teacher by 20 degrees.

Table 1.

Version	1	2	3	4	5	6	7	8	9
Oil, volume %  Temperature, 0C	Oklahoma low sulfur	California heavy	Alaskan NORT slope	Arabic is easy	Luizanka is low-sulfur	West Texas sulfur	Nigerian Bonny Light	Ukraine. Poltava field, well No. 12	Russia. Tyumen deposit. Well No. 31
<45	5.1	–	8	11	10	thirteen	15	15	5
45...105	9.2	–	7	9	8	12	12	12	8
105...125	4.0	–	4	4	5	3	4	9	5
125...155	5.7	4.2	5	6	7	10	9	8	3
155...200	9.3	5.1	6	8	10	7	7	8	5
200...230	5.4	4.8	5	6	6	6	8	7	3
230...260	5.8	8.5	7	7	7.5	6	8	10	6
260...290	4.7	7.9	6	7	6.5	6	7	4	8
290...345	10.8	8.0	6	5	5	5	5	9	10

345...400	8.6	14.8	9	5	5	5	5	6	11
400...480	13.5	15.1	14	9	9	8	12	5	11
480...540	5.9	13.4	16	thirteen	15	thirteen	8	7	12
>540	12.0	18.1	7	10	6	6	—	—	thirteen

Table 2. Fractions and their densities:

Version	Faction	Densities of oil product fractions $\rho_4^{20}$ ,
1.	Hydrocarbon gases (ethane, methane, propane, butane)	0.29
2.	Gasoline (in foreign literature – gasoline)	0.75
3.	Oil (heavy gasoline, gasoline-legroin fraction or legroin)	0.856
4.	Fuel for jet engines	0.86
5.	Kerosene is a solvent	0.88
6.	Household kerosene and kerosene for lighting	0.90
7.	Diesel fraction	0.92
8.	Gas oil	0.95
9.	Oil fuel	0.97
10.	Tar	0.99

*Working program of the academic discipline (syllabus):*

*Compiled by associate professor of the Department of the Moscow State University, candidate of technical sciences, associate professor Andrii Stepaniuk*

*Approved by the Department of the Academy of Medical Sciences (protocol No. 20 dated June 20, 2022)*

*Agreed by the Methodical Commission of the faculty (protocol No. 10 dated 24.06.2022)*