MINISTRY OF EDUCATION AND SCIENCE,
YOUTH AND SPORT OF UKRAINE
National Aviation University

POWER ENGINEERING

Method Guide
to Doing Homework Assigment
for students of specialty 6.050604
"Energy Mechanical Engineering"

Kyiv 2012

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Т381

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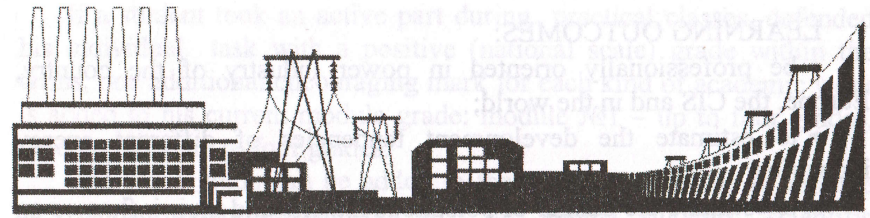
Містять програму, рекомендації до вивчення дисципліни, питання для самоконтролю, завдання для виконання домашньої контрольної роботи та список літератури.

Для студентів напряму підготовки 6.050604 «Енерго-машинобудування» всіх форм навчання.

Power engineering: Method Guide to Doing Homework Assigment / Т381 A.P. Voznyuk, P.I. Grekov, K.I. Kapitanchuk [and others]. – K. : NAU, 2012. – 28 p.

The method instructions contain the program, the list of literature and recommendations concerning subject study, questions for self-check and home tasks.

Intended for first year students of specialty 6.050604 "Energy Mechanical Engineering"



METHODOLOGICAL STUDY GUIDE

The discipline "Power Engineering" is the first professionally oriented course aimed at giving a student basic professional knowledge in the field of power industries.

This course provides the access to the bases of power engineering knowledge in the field of gas transportation, storage, distribution, extraction and its reprocessing into different energy types.

The aim of this course is to familiarize students with gas-turbine installations, gas compressors, compressor stations, main gas pipelines, automotive gas compressor filling stations and other power units and equipment.

The discipline is to deepen students' knowledge necessary for successful mastering the subsequent material of special courses on "Energy Mechanical Engineering", to teach future bachelors the bases of professional oriented subjects, basic technical and power concepts, to give general knowledge on principle of power plant, compressor stations, gas-turbine units and other power devices operation and construction.

The subject matter of the discipline is divided into two modules.

As a result of studying the material of module "General Power Engineering" a student shall

KNOW:

- basic types of fuel, their resources in the country, Europe, the CIS and in the world;
- development prospects of power industries of Ukraine, gas in particular;
- development importance and prospects of gas-transporting system of Ukraine;
- main harmful properties of gas and other poisonous matters, basis of labor precaution.

LEARNING OUTCOMES:

- be professionally oriented in power industry of the country, Europe, the CIS and in the world;
- to estimate the development tendencies of different energy industries;
- to estimate the danger of poisonous matters and their influence on people's health and environment.

As a result of studying the material of module № 2 "Power Engineering" a student shall

KNOW:

- structure of "Naftogaz of Ukraine";
- scheme and composition of the gas-transporting system of Ukraine;
- methods of gas production, preparation, transportation and processing for its conversion into different types of energy convenient for consumption (for example, in thermal or electrical);
- principles of construction and operation of gas transporting main units;
- equipment for individual and collective protection of gas industry workers against harmful action of gas and other poisonous matters.

LEARNING OUTCOMES:

- to read drawings, schematic diagrams, pictures of operation mode and principle of different kinds of devices of "Ukrnaftogaz" units;
- be professionally oriented in gas engineering;
- to estimate the dangerous effect of gas and poisonous matters on people's health and environment.

The discipline "Power Engineering" is studied in the 1st semester and is equivalent to 108 hours, 57 hours are devoted to self-study work done by a student using the recommended literature and periodical magazines. When a student masters both theoretical and practical material on a given subject and defends his/her individual tasks he/she takes the differentiated test on the course.

Grading of different kinds of academic work performed by a student is done in values in accordance with Table 1. All kinds of academic work consists of grades which a student gets for a certain kind of work and receives a positive mark in accordance with the national scale (Table 2.)

If a student took an active part during practical classes, defended his individual task with a positive (national scale) grade within the terms, one additional encouraging mark for each kind of academic work is added to his current module grade: module №1 – up to four grades, module №2 – up to four grades.

One more grade can be added to the test module grade of module №2, if a student participated in the annual students' scientific conferences (lecture, report) or Olympiads in the discipline.

The grades a student has been given for the different kinds of academic work are summed up and the result constituting a current module grad is entered into the Module Grade Register.

If a student successfully (with positive in national scale grades) performs his/her pre-assigned set of academic tasks in this module he/she is allowed to take the module test.

Module form of grading is carried out by a board of examiners headed by the chief of the department. A student does a module control work; the procedure lasts up to two academic hours.

The sum of current module grade and test module grades makes the total module grade and is determined in values and in national scale grades in accordance with a table given in addition 3.

A student is considered to have passed the module if his/her current module grade and module test grade (addition 2) are positive according to the national scale which yields a positive Total Module Grade (addition 3).

In this case a student must execute an additional individual task stated by the teacher on the subject being studied and defend it with positive (according to the national scale) grade (addition 2), which must be added to the current module grade.

Note: If a student carries out his/her tasks with delay, misses classes without a valid reason, or does not have the required working material during a semester and did not get or got little encouraging grades then despite the fact that he/she got some positive (according to the national scale) module current grades for some kinds of academic work and positive control module test grades, it does not guarantee him/her, that the total module grade will be positive.

If a student has missed the module test due to any reason (being ill, debarred, etc.) the entry "absent" is made against his/her name in the column "Module Test Grade" and the entry "unclassified" – in the column "Total Module Grade".

The student is considered as not having an academic incomplete if he/she is allowed to take his/her module test but has missed it due to a valid reason. Otherwise he/she is considered as having an academic incomplete.

A student who has not got a positive examination grade is not considered to have passed the semester course in this discipline and is to be re-examined in accordance with the established procedure.

A Module Test Grade that a student can be given after the second testing cannot be higher than "good" according to the national scale, i.e. the grade value presented in addition 2 is reduced by 1.

A student is not allowed to increase his/her positive Total Module Grade by taking a repetitive test or exam.

The Semester Module Grade is calculated as the sum of the Total Module Grades. The correspondence between Semester Module Grade values and the National Scale is given in addition 4.

A student having a positive (higher than "bad" according to the national scale) Semester Module Grade is allowed to take a semester exam (or differentiated test) and valued in accordance with the table in addition 5.

The Semester Module Grade and the Examination Grade together make up a Total Semester Grade whose correspondence to the National Scale and the ECTS Scale is shown in addition 6.

The Total Semester Grade is entered into the Examination Register and into a student's record book in values, National Scale grades and ECTS Scale grades, for example: 98/Ex/A, 89/Good/B, 82/Good /C, 72/Sat./D, 61/Sat./E, etc.

METHODICAL GUIDELINES FOR COURSE SECTIONS STUDY

Module 1. GENERAL POWER ENGINEERING

1.1. General and Historical Prospects of Power Industry Development

The subject and purpose of the course. The place and role of the course in preparation of future experts of gas facilities of Ukraine. Basic concepts, abbreviations, acronyms and terms in the field of power technics and gas facilities of Ukraine.

Historical data of the power industry development and prospects of gas power industry development in Ukraine. The role of gas power industry as one of the major branches of modern Ukraine.

Literature: [1, p. 3–32]; [2, p. 49–51]; [3, p. 57–64]; [4, p. 5–22; 142–184]; [5, p. 3–85].

Methodical Guidelines

Information about general and historical data of the development of Ukraine power engineering and basic concepts, definitions, abbreviations, terms in the field of gas power can be found in the periodical and special literature but it is advisable to make notes while taking lectures on the course.

Quiz

1. When was oil recovery in Ukraine begun, and what for ?
2. When was industrial gas production in Ukraine begun?
3. When was the first gas main in Ukraine constructed?
4. What kinds of power do you know?
5. What position does gas power take in Ukraine ?
6. What is the importance of gas facilities in industries, on transport and in household?
7. What role does gas facilities of Ukraine play for gas supply to the Western Europe countries?

1.2. Kinds of energy and its source

Kinds of energy. Solar, space and other radiant energy. Thermal energy. Wind power, currents and waves. Energy of chemical reactions. Energy of nuclear reactions. Energy of planets and oceans. Energy of heat-mass transfer. Energy sources: the Sun, wind, water, the Earth, Space.

Literature: [1, c. 3–33]; [2, c. 23–138]; [3, c. 57–65]; [7–11].

Methodical Guidelines

Studying this section, it is necessary to have notion about variety of kinds of energy, its source and conversion of one kind into another at its quantitative conservation.

Quiz

1. What kinds of energy do you know?
2. What are different energy sources?
3. In what way do different kinds of energy convert into others?
4. What law governs the conversion of one kind of energy into another?

1.3. Natural Fossil Fuels and Their Resources

Minerals: solid, liquid, gaseous and nuclear fuel for energy generation. Solid fuel: coal, peat, combustible slates. Liquid fuel: oil and mineral oil: gasoline, kerosene, benzene, diesel fuel, etc.

Gaseous fuel: natural gas, methane, butane and other accompanying condensed gases.

Nuclear fuel: uranium and trans-uranium, plutonium and accompanying elements, hydrogen, heavy hydrogen, tritium. Resource capacities of the country, in the world, etc.

Literature: [1, p. 3–33]; [2, p. 23–138]; [3, p. 57–65]; [4, p. 33–75]; [5, p. 6–29]; [6, 10, 18]; [19, p. 29–39].

Methodical Guidelines

While studying this section it is necessary to pay special attention to different kinds of mineral fuel such as solid, liquid and nuclear fuel and to consider the resource capacities in Ukraine and in the world.

Quiz

1. What kinds of mineral fuel do you know? What kinds of power industry are they used at?

2. What kinds of solid fuel do you know? Where are they used?
3. What kinds of liquid fuel do you know? Where are they used?
4. What kinds of gaseous fuel and accompanying gases do you know? Where are they used?
5. What kinds of nuclear fuel do you know ? What are their application?
6. What power minerals resources does Ukraine possess?
7. What portion of world resources does it constitute?

1.4. Natural Elemental Energy Sources

Solar radiant energy, its kinds and resources. Wind energy and power, its resources.

Energy of sea and ocean waves, tide and ebb. Energy of ocean currents. Possibilities of these resources usage.

Literature: [1, p. 3–33]; [2, p. 23–36]; [3, p. 57–65]; [7–9]; [11]; [18]; [19, p. 29–39].

Methodical Guidelines

In this section information about natural elemental sources that are unlimited and inexhaustible is presented. But nevertheless they have limited use possibilities for limited purposes.

For example, in Denmark there are windmills which are used for generating electricity and grinding grain.

Quiz

1. What kinds of radiant energy do you know? What energy does the Sun radiate?
2. In what way can solar energy be used? Who was the first to suggest its use?
3. How is wind energy used?
4. What are resources and prospects of using wind power in Ukraine?
5. How is energy of sea waves, tides and ebbs used?
6. What do you know about energy of ocean currents and possibilities of their use?

1.5. Alternative Energy Sources and Technologies of their Use. Development Potential of Local Power Industry in Ukraine

The sun, solar power plants. Their design and use of solar energy. The wind, wind-driven power plants. Their design and wind power use. The sea, ocean, tidal power plants, their design and energy use of seas and oceans.

The Earth, geothermal energy sources and geothermal power plants, use of the Earth heat. Energy of coal dust, methane, condensates and other power sources.

Gaseous medium energy released at a gas parameters change and other energy sources with the equipment for their generation and use.

Literature: [1, p. 3–33]; [2, p. 241–252]; [3, p. 241–252]; [5, p. 6–10]; [7, p. 3–45]; [8, p. 3–250]; [9, p. 110–199].

Methodical Guidelines

In this section, along with alternative energy sources study, much attention will be paid to economic efficiency and practical objectives of different energy sources for technical projects resolution. Thus it is necessary to correlate quantity and capacity of power plants, the equipment and potential energy consumers.

Quiz

1. What is the design of solar power plants?
2. Where can it be located?
3. What is the operation principle of wind-driver power plants?
4. What are resource opportunities of Ukraine for wind-driver power plants usage?
5. Speak about the operation principle of tidal power plants and the resource opportunities of Ukraine.
6. What is a geothermal power plant?
7. What are the prospects of geothermal power plants development in Ukraine?
8. What other alternative energy sources do you know?
9. How can alternative energy sources be used?
10. How efficient is alternative energy sources usage for the economy of Ukraine?

1.6. Present Situation and Prospects of Power Industry Development

Present situation and prospects of the development of the oil-and-gas industry of Ukraine. Development of power industry in the world. Prospects prediction of world power industry development by 2020. Prospects of alternative kinds of energy by 2020.

Literature: [1, p. C-33]; [2, p. 5–255]; [3, p. 3–65]; [4, p. 99–184]; [5, p. 159–98]; [9, p. 110–199].

Methodical Guidelines

This section presents material concerning domestic [1, 3, 4], and foreign [2] documents about perspective development of power engineering of Ukraine and worldwide. Study them thoroughly.

Quiz

1. What part of energy is produced from liquid fuel in Ukraine?
2. What are the development prospects of oil industry in Ukraine?
3. What part of gas energy is produced and consumed in Ukraine?
4. What are the development prospects of oil-and-gas power industry in the world?
5. What portion will gas power industry take place in the world by 2020?

1.7. Value of Different Kinds of Fuel and Energy Received from them

The value of different kinds of fuel and energy received from them depending on economy, power, ecology, techniques and technology of their extraction, processing, storage, transportation and use. The value of processing equipment for different kinds of energy use. The role and value of gas as energy resource, its extraction, transportation and consumption.

Literature: [1, p. 3–33]; [2, p. 5–23]; [3, p. 12–57; 65–200]; [4, p. 5–23]; [5, p. 3–29].

Methodical Guidelines

In this section you are to estimate all kinds of energy resources both qualitatively and quantitatively at the same time to give preferences to more promising and progressive energy sources at the first stage and not to forget about the strategic importance of those energy resources which prevail in resourceful opportunities of the state. At any rate it is not advisable to ignore them, and if possible use them.

Quiz

1. Which minerals fuels in your opinion are the most valuable and why?
2. Why solid fuel is inferior to oil and gas? Prove this fact.
3. Why cannot nuclear fuel compete with liquid and gaseous fuel in its value?
4. Why cannot alternative energy sources compete with liquid and gaseous energy carriers?

1.8. Structure of the Power System in Ukraine and Highly Developed Countries of the World

The place and role of power engineering in the power system of Ukraine, gas system in particular. Share of production and consumption of gas power fuel in Ukraine in comparison with the countries of Europe and America. The structure and values of gas industry of Ukraine in the power balance of Ukraine. Trends and prospects of the gas industry development in Ukraine. Specification and parameters of generation and consumption of different kinds of energy.

Literature: [1, p. 3–33]; [2, p. 42–57]; [3, p. 109–119]; [4, p. 142–184]; [5, p. 53–198]; [18–19].

Methodical Guidelines

When studying this section it is necessary to comprehend the historical development peculiarities of power branches in Ukraine, oil-and-gas power in particular and the tendency of their development in comparison with the countries of Europe and America.

Special attention should be paid to specifications and parameters of production and consumption of gas in Ukraine and tendencies of their changes in the nearest future.

Quiz

1. Historical data as to the development of power of Ukraine.
2. Where was industrial oil and gas production started in Ukraine for the first time and when?
3. What are the biggest deposits of gas in Ukraine and its greatest extraction?
4. What is modern structural scheme of power fuel consumption in Ukraine, gas in particular
5. What are the development prospects of structural scheme of power fuel consumption in Ukraine, gas in particular.

Module 2. POWER ENGINEERING

2.1. Ways of mineral fuel extraction and its conversion into energy (labor consumption, operating economy, cost effectiveness)

Ways of extraction of mineral fuel: solid, liquid, gaseous and nuclear fuel. Ways of fuel usage for power needs. Ways of energy conversion into heat and electricity.

Literature: [1, p. 17–33]; [2, p. 23–103; 154–178]; [3, p. 57–88]; [4, p. 142–184]; [5, p. 3–85].

Methodical Guidelines

When studying this section, attention should be concentrated on labor consumption, operating economy for extraction, transportation and processing of mineral fuel into other forms of energy adapted for easier transportation, storage and use. Are there, to your mind, any ways of direct energy conversion into its convenient form for consumption?

Quiz

1. What ways of solid fuel extraction do you know?
2. How is solid fuel used for power needs in the industries and for domestic purposes?
3. What ways of extraction of liquid fuel do you know?
4. How is liquid fuel used in the industry, engineering and for domestic purposes?
5. How is gaseous fuel produced, transported, stored for various needs?
6. How is nuclear fuel produced, processed and used?
7. Which of the known ways of extraction of power minerals from solid, liquid, gaseous and nuclear fuel is the most environmentally friendly?
8. Which of the known ways of power minerals extraction from solid, liquid, gaseous and nuclear fuel are less costly?

2.2. Technologies of Energy Production, Processing and Transportation

Technology of generation, processing and transportation of energy. Technological operations and the process equipment. Energy saving technologies in the power industry.

Literature: [1, p. 3–33]; [2, p. 136–154]; [3, p. 32–35; 218–241]; [4, p. 90–184; 255–290]; [5, p. 29–132].

Methodical Guidelines

When studying this section, attention should be concentrated on adaptability to manufacture, environmentally friendly generation, processing and transportation of energy. Technological operations and equipment. Power saving technologies for gas industry.

Quiz

1. What technological processes are applied for production, processing and transportation of energy from solid fuel (coal, peat, slate)?
2. What technological processes are applied for production, processing and transportation of energy from liquid fuel (oil, diesel oils, gasoline, kerosene, benzene, etc.)?
3. What technological processes are applied for generation, processing and transportation of energy from gaseous fuel (gas, methane, butane, etc,)?
4. What technological processes are applied for production, processing and transportation of energy from nuclear fuel (uranium, ran uranium, plutonium, heavy hydrogen, tritium, etc.)?
5. Which of technological processes of generation, processing and transportation of energy are the most efficient, environmentally friendly and practically feasible?

2.3. Technology of Saving and Useof Different Kinds of Energy

Ways and technology of saving of different kinds of energy. Objects and equipment. Technology of use of different kinds of energy, installations and equipment. Energy saving technologies.

Literature: [1, p. 3–33]; [2, p. 136–153]; [3, p. 218–258]; [4, p. 90–214; 359–375]; [19, p. 42–46].

Methodical Guidelines

This section deals with economic, ecological and technological posibility of different kinds of energy to be stored and used.

Quiz

1. What ways and technologies of saving different kinds of energy do you know?
2. What are objects and equipment for saving different kinds of energy?
3. What technologies of use of different kinds of energy do you know?
4. Name objects and equipment for use of different kinds of energy.
5. What efficient technologies of energy use do you know?

2.4. Plants and Processing Techniques of Conversion of Different Kinds of Energy into Heat and Electricity

Plants for processing different kinds of energy into states convenient for transportation and use. Transportation of solid, liquid, gaseous and nuclear fuel to the processing plants. Energy-efficient technologies of processing and transportation of energy of different kinds to power stations, hydroelectric plants, nuclear plants, thermoelectric plants. The equipment of the plants.

Literature: [1, p. 101–550]; [2, p. 154–194]; [3, p. 93–218]; [4, p. 255–282]; [5, p. 53–132]; [6, p. 3–440]; [9, p. 110–199]; [10, p. 3–184]; [11, p. 3–200].

Methodical Guidelines

In this section it is important to get acquaintance with the plants equipment for processing different kinds of energy into states convenient for transportation and use, for example, electricity, thermal energy, gas, water and others, that are supplied to consumers.

It is necessary to remember energy-saving technologies used for transportation and processing of different kinds of energy to the processing plants.

Quiz

1. What kind of equipment and scheme of generation of electricity, thermal energy, gas and other energy resources from coal do you know?
2. What kind of equipment for processing black oil and oil convenient for their transportation and consumption do you know?
3. Which kind of energy resources is mostly suitable for transportation and consumption?
4. Which kind of energy resources has the best properties that allow to apply energy saving and environmentally friendly technologies to them.

2.5. Structure, Parameters and Values of Gas-Transporting System of Ukraine. Structure and Present Condition of Gas-Transporting System of Ukraine

Structure of gas-transporting system of Ukraine. Its place and role in the life of the country. The gas mains of gas-transporting system of Ukraine. The role of gas-transporting system of Ukraine for gas supply

to European countries, the Middle East, and economic development of the consumer states.

Literature: [3, p. 5–35; 93–119; 370–391]; [4, p. 255–282; 359–378]; [5, p. 38–255]; [14–16]; [18].

Methodical Guidelines

When studying this section attention should be paid to the structure of gas-transporting system of Ukraine, its capacities and parameters for satisfying the needs of Ukraine, European countries and the Middle East, its role as transit transport country for economy of these states. Structure and layout of gas-transporting system of Ukraine. Structure of Ukrtransgaz, its systems and affiliated companies. Layout of gas-transporting system of the main gas pipelines, compressor stations, gas pumping stations with different drives, gas-distribution stations and units, gas-distribution networks of gas consumers.

Auxiliary special systems, control measuring stations, devices and automatic control of telemechanics, communication, signaling system of normal work or emergency warning. General condition of gas-transport system of Ukraine.

Quiz

1. The main transporting lines of gas and oil in Ukraine.
2. Gas transporting pipelines for supply and consumption in Ukraine.
3. Transit transporting gas pipelines for the states of Europe and Asia.
4. Key parameters of gas supply to Ukraine and other states.
5. Value and role of gas-transporting system of Ukraine for the economy of European and the Middle East states.
6. What was the reason for the creation of international gas-transport consortium?
7. What provides reliable operation of Ukrtransgaz systems?
8. Name auxiliary systems and units which provide normal operation of Ukrtransgaz subdivisions.
9. What is the principle of diagnostic systems?
10. Characterize the general situation in the gas-transporting system of Ukraine.
11. What are basic features of gas-transporting system of Ukraine?

2.6. Basic Objects of Gas-Transporting System

Basic power equipment of gas supply. Main deposits and underground storages of gas. Oil drilling rigs and boreholes. System of

boreholes connection with gas refining station for separation from condensed gas and accompanying heavy gases.

Separation of butane and other heavy accompanying gases and condensed gas. Gas drying, odorizers and their purpose. Gas-distribution stations and points, gas-distribution network.

Basic power equipment of gas supply. Internal combustion engines: domestic and foreign ones, piston units with electric drive, gas-turbine drive from a gas-turbine plant, at compressor stations and automobile gas filling stations. Their number and condition in the system of Ukrtransgaz and Ukravtogaz.

Literature: [4, p. 45–90; 142–214]; [5, p. 85–198]; [10–19].

Methodical Guidelines

This section presents information about basic deposits and underground storages on the territory of Ukraine, their role and value. Remember the main objects of gas-transport system starting from gas deposits to gas consumers with systems of refining and drying of gas, its odorizing before consumption, i.e. basic power equipment of gas supply to consumers.

Mind the complexity, age, capacity, efficiency and profitability of power equipment.

Quiz

1. List the main gas-bearing deposits on the territory of Ukraine.
2. Name the main underground gas storage in Ukraine.
3. Name the main objects of gas-transporting system from deposits to gas consumers (or underground storage).
4. What is the role of power plants in the objects of Ukrtransgaz?
5. What role do gas filling stations play in the system of Ukrtransgaz and Ukravtogaz?
6. Name the number and place of gas filling stations approximate location.

2.7. Equipment for Energy Production, Processing and Use. Gas Supply Basic Power Equipment of. Its Design and Operation Principle

Mines, open pits, boreholes, pitsand and their equipment for extraction of solid, liquid, gaseous and nuclear fuel. Fuel processing plants. Processing plants for power fuel conversion into thermal, electric and other kinds of energy, which are suitable for transportation, storage

and use. Transporting systems, liquid and gaseous fuel storages. Railway systems, oil pipelines, gas mains and their systems. Energy consumers and their equipment.

Literature: [1, p. 3–33]; [2, p. 8–112]; [3, p. 93–218]; [4, p. 255–282]; [5, p. 29–145]; [9, p. 10–199]; [16–19].

Methodical Guidelines

When studying this section, it is necessary to remember not only various equipment used for generation, processing, transportation, storage and use of energy, but also its complexity, steel volume and power consumption, adaptability to manufacture and profitability of all projects.

Quiz

1. Speak about projects of production, transportation, storage and consumption of solid fuel energy.
2. Speak about contract designs of liquid fuel use.
3. Speak about contract designs of gas condensate deposits use.
4. Speak about the equipment of alternative energy sources.

2.8. Design and service procedures of the Natural Gas Vehicle Fueling Stations (NGVFS). NGVFS system of Ukraine. Prospects of Development

NGVFS as a provider of automobile transport fuel. National distribution of Ukraine NGVFS system. Stations equipment. Worldwide experience of CNG use. Perspectives of CNG development in Ukraine.

Literature: [21, c. 127–133, 169–176, 281–284].

Methodical Guidelines

In this section it is necessary to pay attention to the service procedures of compressor stations during vehicle gas filling and stations equipment. Regulations and safety precautions observed during NGVFS operations. Necessary requirements for NGVFS location and its impact on the ecology environment.

Quiz

1. Describe the service procedures of NGVFS.
2. What is the main NGVFS equipment?
3. Design principles and technological scheme of NGVFS.
4. Safety precautions during motor vehicles refuelling.
5. What role do natural gas vehicle filling stations play in the system of Ukrtransgaz and Ukravtogaz?
6. Name the number and place of gas filling stations approximate location.

TESTS AND HOME ASSIGNMENTS

The volume and content of tests and home-tasks are defined by the form of tuition - full-time and correspondent students, i.e. the volume of student's self-study work to master the material of the discipline.

As full-time students have ability to communicate with the teacher on lectures and at practical training so there is a form of direct testing on the lecture or during practical training. The correspondent students practically master the material on the discipline on their own. The form of testing is an interview at differentiated test and execution and defense of an individual home-task.

The test or home assignment is executed on one of the discipline "Power Equipment" by students of both tuition forms. The execution of home-task takes up to 8 hours of student's self-study.

The subject of home-task (abstract) from discipline "Power Equipment" is approved by the department board, and the theme of an individual assignment is proposed to the student by the leading lecturer.

Written paper should have: the cover page, the homework contents with listing of pages, the homework explanation note about 15–20 pages of A4 size, including the description of power equipment objects and answers to questions (questions should be listed), graphic material, pictures, sketches, plans, schemes, tables, etc. The last page should include the references named "Literature".

APPENDIX 1

Grading

Module 1		Module 2		Max. Number of grades
Work type	Max. Number of grades	Work type	Max. Number of grades	
Mastering and defense of practical work 1.1–1.2	8	Mastering and defense of practical work 2.1	8	
Mastering and defense of practical work 1.1–1.2	8	Mastering and defense of practical work 2.2	8	
Execution and defense of Homework	12	Mastering and defense of practical work 2.3	8	
		Mastering and defense of practical work 2.4	8	
		Mastering and defense of practical work 2.5	8	
Module 1 test	10	Module 2 test	10	
Total Module Grade 1	38	Total Module Grade 2	50	
Deferential Test				12
Total of 1 Semester				100

APPENDIX 2

Correspondence between grade values for the separate kinds of academic work and national scale

Grade values (homework)	Grade values (practical work)	Module test	National scale
11–12	8	9–10	Excellent
9–10	6–7	8	Good
7–8	5	6-7	Satisfactory
Under 7	Under 5	Under 6	Bad

APPENDIX 3

Correspondence between grade values in points for the separate kinds of academic work and national scale

Module 1	Module 2	National scale
34–38	45–50	Excellent
29–33	38–44	Good
23–28	30–37	Satisfactory
Under 23	Under 30	Bad

APPENDIX 4

Correspondence between final module grade values and national scale

Points	National scale
79–88	Excellent
66–78	Good
53–65	Satisfactory
Less then 53	Bad

APPENDIX 5

Correspondence between grade values and national scale

Grade values	National scale
12	Excellent
10	Good
8	Satisfactory
Under 8	Bad

APPENDIX 6

Correspondence between grade values and national and ECTS scale

Grade values	National scale	ECTS Scale	
		Grade	Explanation
90–100	Excellent	A	**Excellent** (excellent performance with insignificant shortcomings)

Appendix 6. End

Grade values	National scale	ECTS Scale	
		Grade	Explanation
82–89	Good	B	**Very Good** (performance above the average standard with a few mistakes)
75–81		C	**Good** (good performance altogether with a certain number of significant mistakes)
67–74	Satisfactory	D	**Satisfactory** (performance meets the average standards)
60–66		E	**Sufficient** (performance meets the minimal criteria)
35–59	Bad	FX	**Bad** (bad performance; a second testing is required)
1–34		F	**Bad** (very bad performance a student shall retake the course)

APPENDIX 7

Topics for home problems (abstracts) on discipline "Power Engineering"

1. World power. Current condition and the development forecasts
   - 1.1. Energy of the Sun
   - 1.2. Energy of seas and oceans
   - 1.3. Energy of atmosphere
   - 1.4. Energy of the Earth. An atomic energy
   - 1.5. Problems of power and ecology
2. Power complex of Ukraine and its problems
   - 2.1. Power safety of Ukraine.
   - 2.2. Power problems and power prospects of Ukraine
   - 2.3. Fuel problems of Ukraine power engineering
   - 2.4. Power: view point from Kiev

2.5. Results of power branches operation for last few years
2.6. Perspective development trends of power of Ukraine
2.7. Power complex of Ukraine
2.8. Energy resources – serious problem for Ukraine
2.9. Influence of fuel and energy complex on economy of Ukraine
2.10. Power engineering today
2.11. Features of accommodation and problem of electric power industry of Ukraine
2.12. Fuel and energy resources of Ukraine
2.13. Power FLEW: a petroleum industry

3. Structure and problems of the company "Ukrnaftogaz"
3.1. "Ukrnaftogaz", its parameters and opportunities
3.2. Problems and prospects of development of oil-and-gas industries of Ukraine
3.3. Scientific and technical progress in oil-and-gas industry in XXI century
3.4. Petroleum industry of Ukraine
3.5. Gas industry of Russia

4. Transportation of power resources
4.1. Transportation of oil and gas
4.2. Gas-transporting system of Ukraine
4.3. Classification of gas mains and gas pipelines of consumers (ГРМ)
4.4. Gas main – the most complicated engineering construction
4.5. Transport and oil and gas conservation
4.6. Maintenance, service and repair of gas mains
4.7. Development of pipeline gas transportation in Ukraine
4.8. Corporation " Ukrzarubijnaftogaz "
4.9 Scientific and technical progress in oil-and-gas industry of Ukraine
4.10. Fixed capital in the oil-and-gas industry of Ukraine
4.11. Oil origin and structure
4.12. Oil - production, processing, cracking
4.13. Technique and technology of oil and gas refining
4.14. Production of oil, gas and other fuels; their practical application
4.15. Peculiarities of nonhydrate operation of gas condensate wells
4.16. Fight against loss of gas and petroleum products

4.17. Geography, geology and technique of oil and gas production
4.18. Drilling Technique and drill holes

5. Traditional energy sources
5.1. Hydroelectric power stations
5.2. Power industry of Ukraine
5.3. Bases of modern electric power industry
5.4. Modern ways of different kinds of energy generation into electric energy
5.5. Electricity and heat plant
5.6. Direct energy generation
5.7. Problems of power supply and methods of their decisions
5.8. Geography of thermal electric power industry of Ukraine
5.9. Electric power industry in the CIS countries
5.10 Geography of power engineering development of Russia
5.11. Electric power industry of Russia
5.12. Geography of heat power industry of Russia
5.13. Atomic power stations and their safety
5.14. Condition and prospects of nuclear power of Ukraine
5.15. The basis of nuclear power. Nuclear reactions and devices
5.16. Power of the atomic power station - "Pro and contra"

6. Alternative and nonconventional energy sources
6.1. Nonconventional sources of electric energy.
6.2. Alternative energy of Ukraine
6.3. Use of alternative energy in Crimea and in Ukraine
6.4. Power Potential Renewable non-conventional energy sources and its opportunity realizations
6.5. Condition and prospects of use of a wind power
6.6. Not renewable resources of energy
6.7. Solar energy and prospects of its use and conversion
6.8. Geography of solar power engineering
6.9. Power engineering of the future
6.10. Energy, its kinds and correlation with people community

7. Ecology of power engineering
7.1. Power engineering and the environment
7.2. Power engineering and mankind
7.3. Influence of power engineering and other activities on planetary balance
7.4. Environmental protection

Навчальне видання

ТЕХНІКА ЕНЕРГЕТИКИ

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до виконання домашнього завдання
для студентів напряму підготовки
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