MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION OF THE REPUBLIC OF UZBEKISTAN

KARSHI ENGINEERING-ECONOMIC INSTITUTE

"CONFIRM"
Karshi engineering-Economics Institute rectors O.Sh. Bazarov

"___" __________ 2021 year

THERMODYNAMIC CYCLES OF ENERGY DEVICES

CURRICULUM

Field of knowledge: 300000 – Production is a technical field

Field of study: 310000 – Engineering work

Areas of study: 5310100 – Energy (thermal energy)

Karshi – 2021

The curriculum of the science was developed at the Karshi Institute of Engineering and Economics..

Curriculum of Science Karshi Institute of Engineering and Economics Department of "Thermal Power Engineering" №.1 20__ "23" 08 in 2021, Methodological Commission of the Faculty of Energy No. 2021 in "__" ______ No. 2021 and Methodological Council of the Institute in 2021 "08" 24 № 1 considered at meetings. Discussed by the Academic Council of the Institute (2021 "28" 08, resolution № 1).

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Introduction

The program includes lectures, practical classes and topics of independent work on the subject "Thermodynamic Cycles Of Energy Devices", as well as information and methodological support, history and development trends of the subject and the prospects and results of socio-economic reforms in the country. levels.

Recently, there has been a rapid development of technological processes in the energy and other industries. In the field of thermal energy, the increase in primary capacity by 10-15 times in recent years, also increases the speed of technological processes, and the number of cycles performed in them is growing.

Nowadays, it is hard to imagine energy without modern devices. The correct choice of thermodynamic processes and cycles in power equipment ensures reliable operation of devices, production safety, increased energy efficiency of devices. Production cycles and energy savings, especially the cycles of technological processes, are important in solving the energy problems of large-capacity devices.

Given the fact that our country attaches great importance to the issues of saving heat and electricity, and recently a number of decisions of national importance, we can see the importance of improving the thermodynamic processes and cycles of power plants..

Goals and objectives of the subject.

The purpose of teaching science is to form knowledge, skills and competencies in the field of thermal energy in each student studying the types, structure, principle of operation of heat engines, their thermodynamic cycles and thermodynamic processes and heat transfer and heat transfer.

The main task of the subject "Thermodynamic Cycles Of Energy Devices", is to teach students the theory, types and structure of heat engines, the formation of water vapor and the formation of heat and electricity by water vapor, refrigeration machines and their cooling cycles, power plant cycles and their useful work. is to teach ways to increase the coefficient.

To the knowledge, skills andskill requirements

In the framework of the study of the subject "Thermodynamic Cycles Of Energy Devices", bachelor:

- know the thermodynamic processes, trends in the development of heat engines, steam turbines, their types, structure and principle of operation;
- have the skills to determine the design parameters of gas turbine units, internal combustion engines, compressor units and the correct selection and calculation of the operating condition on an economical basis;

- The student must have the skills of technical, economic and theoretical analysis of thermodynamic processes, heat engines, their efficient use, determination of optimal performance and operating conditions.

The interrelationship of science with other disciplines in the curriculum and the methodological coherence

The subject "Thermodynamic Cycles Of Energy Devices", is an elective subject taught in 5 semesters. Implementation of the program requires sufficient knowledge and skills in mathematics and natural sciences (higher mathematics, physics, theoretical mechanics) planned in the curriculum.

The role of science in production

At present, the energy system consists mainly of thermal power plants. In Uzbekistan, 80% of electricity is generated by thermal power plants. To study and analyze the thermodynamic processes that take place in them, it is necessary to know the thermodynamic cycles of energy devices. Therefore, this science is an integral part of the technological system of production in the acquisition of specialization.

Modern information and pedagogical technologies in science teaching

The use of advanced and modern teaching methods, the introduction of new information and pedagogical technologies are important for students to master the science of thermodynamic cycles of energy devices. Textbooks, teaching and methodological aids, lecture texts, handouts, electronic materials and models are used in the study of the subject. Appropriate advanced pedagogical technologies are used in lectures, practical and laboratory classes..

The main part.
The content of theoretical lessons of science

History of thermodynamics, development trends and current state. Development and modern status of energy. Technical thermodynamics is the theoretical basis of thermal energy. The subject and method of thermodynamics. Information on thermodynamic processes. Classification of thermodynamic processes, isochoric, isobaric, isothermal, adiabatic, polytropic processes. Carnot cycle.

Cycles of steam turbine units. Structure and principle of operation of steam turbine units. Carnot's wet steam cycle and its shortcomings. The main cycle of the steam turbine unit (Rankine cycle). Thermal efficiency of the color cycle. P-V, T-S diagram of the steam turbine unit cycle. Supply pump and turbine operation. T-S and h-S diagram of water vapor. Specific consumption of steam and heat. Ways to increase the thermal efficiency of the steam turbine unit. Influence of initial and final parameters on thermal efficiency.

Regenerative cycles of steam turbine units. Regenerative heating of supply water. Regenerative cycles of steam turbine units. Thermodynamic thermal efficiency of the regenerative cycle. The heat balance equation of the supply tank. The heat balance equation of regenerative heaters. Intermediate heating cycles of steam turbine units. Intermediate heating of steam. Steam intermediate heating cycles and its P-V, T-S and h-S diagrams. Influence of intermediate steam heating on the thermal efficiency of a steam turbine unit. Thermal efficiency of the steam intermediate heating cycle. Thermal cycles of steam turbine units. Condensing steam turbine unit cycle. Thermal steam turbine unit cycle. Reverse pressure turbine steam turbine unit cycle. The cycle of a steam turbine unit in which the steam boiler is adjustable. Thermal efficiency of the heating cycle.

Cycles of internal combustion engines. Brief historical information. The principle of operation of internal combustion engines. Cycle of Internal Combustion Engines that transfer heat at constant pressure. Cycle of internal combustion engines with constant heat transfer. Heat Mixed Internal Combustion Engines Cycle. Indicator diagram of internal combustion engines. Cycle diagram of internal combustion engines that transfer heat at constant pressure. Cycle diagram of internal combustion engines with constant heat transfer. Heat Mixed Internal Combustion Engines Cycle Diagram. Comparison of internal combustion engine cycles.

Gas cycles. Compressors. Piston compressors. Single-stage compressors. Multistage reciprocating compressors. Shovel and axle compressors. Turbocompressors. Thermodynamic cycles of the compressor. Compressor indicator diagram. Compressor indicator operation. Polytropic, adiabatic and isothermal compression compressors. The work done by the compressor. Compressor unit capacity and efficiency.

Gas turbine units and jet engines. Structure of gas turbine units. Fluid jet engines. Havoli - jet engines. Pulsating air - jet engines. Compressed air - jet engines. Cycles of gas turbine units. Brighton cycle. Cycles of gas turbine units that generate heat at regenerative and constant pressure. A cycle of gas turbine units with a constant volume of heat (Humphrey cycle). Cycles of jet engines. Ways to increase the thermal efficiency of gas turbine equipment. Cycles of steam and gas appliances. Creation and development of steam and gas appliances. Steam gas cycles. Regenerative Steam Gas Cycles. Binary cycles. Ways to increase the exergetic efficiency of steam and gas appliances.

Cooling devices. Carnot's reverse cycle. Classification of refrigeration equipment. Cooling coefficient. Cold carriers. Thermodynamic cycles of refrigeration equipment. Cycles of air, steam compressor, steam ejector, absorption cooling devices. Thermodynamic cycles of a heat pump. The principle of operation of the heat pump. Compressor and steam compressor heat pump cycle. Air heat pump cycle. Stirling cycle.

Thermodynamic cycles of nuclear power plants. General information about nuclear power plants. Structure and cycles of single, double and triple circuit nuclear power plants. Thermal efficiency of nuclear power plants.

On the organization of practical training instructions and recommendations.

In practical classes, students learn to identify and calculate the cycles of various power devices and their FIC.

Topics of practical training:

1. Calculation of basic thermodynamic processes.
2. Water vapor tables and diagrams.
3. Carnot cycle and its efficiency.
4. Steam turbine unit cycle and Efficiency.
5. Gas turbine unit cycle and efficiency.
6. Internal combustion engine cycle and Efficiency.
7. Compressors and their efficiency.
8. Cooling devices and their efficiency..

Instructions and recommendations on the organization of practical training are developed by professors and teachers of the department. In it, students enrich their knowledge and skills on the main topics of the lecture through practical issues. It is also recommended to strengthen students 'knowledge on the basis of textbooks and manuals, use handouts, increase students' knowledge through the publication of scientific articles and theses, problem solving, preparation of presentations and visual aids, use of laws and regulations, etc.

The form and content of the organization of independent work

It is recommended to use the following forms in the preparation of independent work of the student, taking into account the characteristics of a particular subject:

- study of science chapters and topics in textbooks and manuals;
- mastering the part of lectures on handouts and textbooks;
- work with automated training and control systems;
- work on sections or topics of special literature;
- study of new techniques, equipment, processes and technologies;
- In-depth study of sections and topics related to the student's research work;
- training sessions using active and problem-based learning methods;

distance learning.

Topics of recommended independent work:

1. Calculation of gas cycles.
2. Determine the characteristics of humid air.
3. Determine the characteristics of the steam turbine unit.
4. Efficiency factor of the rank cycle.
5. Ways to increase the efficiency of the gas turbine unit.
6. Carnot cycle.
7. Efficiency factor of the rank cycle.
8. Efficiency of the intermediate steam superheater cycle.
9. Carnot's reverse cycle.
10. Thermodynamic characteristics of Internal Combustion Engines.

It is recommended to use the following forms in the preparation of independent work of the student, taking into account the characteristics of a particular subject:

- study of science chapters and topics in textbooks and manuals;
- work on sections or topics of special literature;
- study of new techniques, devices, processes and technologies;
- In-depth study of sections and topics related to the student's research work;

Information and methodological support of the program

In the process of teaching this subject, the use of modern teaching methods, pedagogical and information and communication technologies is provided:

- In the lectures of the department of steam turbine equipment, gas turbine equipment, internal combustion engines provides for the use of pedagogical technologies KLASTER, SINKVINE, INSERT, CASE-method.
- The use of pedagogical technologies of brainstorming, group thinking in practical training on the issues of the steam turbine cycle.
- Experimental training on thermodynamic cycles of power plants involves the use of "brainstorming", work in small groups ("zigzag", "corners"), pedagogical technologies of group thinking and information and communication technology (computer technology) in the calculation of laboratory work.

Basic textbooks and tutorials used list of guides
Basic textbooks and manuals

1. Zohidov R.A., Alimova M.M., Mavjudova Sh.S. Textbook "Thermal Engineering", T., National Society of Philosophers of Uzbekistan, 2010, -200 p.
2. Larikov N.N. Heating technology. –M .: Stroyizdat, 1985.
3. Kudinov V.A., Kartashov E.M. Technical thermodynamics. -M .: Vysshaya shkola. 2000.
4. Rabinovich O.M. Sbornik assignment on technical thermodynamics. - M .: Mashinostroenie, 1973. - 344 p.

5. Lukanin V.N., Shatrov M.G., Kamfer G.M. Heating technology. –M .: Vysshaya shkola, 2000. - 671 p.

Additional literature

1. Zohidov R.A., Alimova M.M., Mavjudova Sh.S. Collection of problems on technical thermodynamics and heat transfer, Tashkent State Technical University, Tashkent, 2006.

2. Polishchuk G.S., Gurovich B.M., Taktaeva L.N., Koroli M.A. Collection of laboratory works on the discipline: "Theoretical bases of thermal engineering". Chast I. TashGTU. Tashkent, 2004

3. Andrianova T.N. and dr. Sbornik zadach on tehnicheskoy thermodynamics, M .: 2000.

4. Internet information:
http://dhes.ime.mrsu.ru
http://twirpx.com
http://03-ts.ru