MINISTRY OF HIGHER AND SECONDARY SPECIAL

EDUCATION OF THE REPUBLIC OF UZBEKISTAN

KARSHI ENGINEERING - ECONOMIC INSTITUTE

Registered:
№ 5
2021 year " 30 **"** 08

"Affirm"
Vice Rector for Academic Affairs
_____ O.N.Bazorov
"____" _____ 2021 year

"Thermodynamics Cycles of Energy Devices"

WORKING CURRICULUM

Field of knowledge: 300000 – Production is a technical field

Field of study: 310000 – Engineering work

Areas of study: 5310100 – Energy (thermal energy)

Total study hours -	
Including:	**60**
lecture -	**20**
practical training -	**16**
laboratory classes -	**-**
hours of independent study -	**24**

KARSHI – 2021 year.

The working curriculum of the science is approved by the Scientific Council of the Karshi Institute of Engineering and Economics "__" __. It was compiled on the basis of a model program approved by Resolution № in 20__.

Developer: ***The teacher of the department "Thermal energy" S.I.Khamraev***

Working curriculum of the discipline "Thermal Power Engineering" of the Department of "Thermal Power Engineering" No. 1 of 13 08 in 2021, Methodical Commission of the Faculty of Energy No. 1 of 24 05 of 2021, Us ___ of the Methodological Council of the Institute in 2021 "1" 2808 discussed and approved in the.

Institute Methodological Council vice president: _____ **docent. Sh.Turdiev**
(signature)

Faculty of Energy
Chairman of the Methodological Commission: _____ **docent. A. Dusyarov**
(signature)

"Thermal energy"chair manager _____ **docent.T.A.Fayziev**
(signature)

Introduction

Thermal energy occupies one of the leading positions in the development of the national economy and industrial enterprises of the republic.

Today, various power devices are widely used in all existing thermal power plants, thermal power plants and industrial enterprises.

In recent years, the rapid development of the national economy and industry has further increased the demand for energy equipment. Due to the fact that the scope, principle of operation and design of power devices used in these areas are different, their calculation has its own complexities. There is also a rapid development of technological processes in 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. Proper selection of thermodynamic processes and cycles in power equipment ensures reliable operation of devices, production safety, increased energy efficiency of devices. Cycles of technological processes are important in solving energy problems of production efficiency and energy saving, especially large-capacity devices.

Given 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.

Currently, the achievements in the field of "Thermodynamic Cycles of Power Plants" are directly related to the development of steam turbine equipment, the design of steam and gas equipment, the creation of new and modern energy-saving devices and the use of non-conventional energy sources. Therefore, the subject "Thermodynamic cycles of power plants" helps students to develop practical and theoretical skills in the mechanical conversion of thermal energy, understanding the basic laws of thermodynamics and studying the laws of steam and gas turbine devices.

The main goals and objectives of science

The main purpose of the science is to teach each student in these areas the types, structure, principle of operation of thermal energy devices in the field of thermal energy, their thermodynamic cycles and thermodynamic processes, heat transfer and heat transfer. is the formation of knowledge, skills and competencies appropriate to the profile.

The main task of the subject "Thermodynamic cycles of power plants" - to teach students the theory, types and structure of thermal power plants, the formation of water vapor and the processes of heat and electricity generation by

water vapor, cooling devices and their cooling cycles, cycles of power plants and ways to increase their efficiency.

The subject "Thermodynamic cycles of power plants" is an additional subject and is taught in the 5th semester of "Energy (thermal energy)". Implementation of the program requires sufficient knowledge and skills in mathematics and natural sciences (higher mathematics, physics, theoretical mechanics) planned in the curriculum.

Requirements for knowledge, skills and abilities of students in science

In the process of mastering the subject "Thermodynamic cycles of power plants" Bachelor:

- thermodynamic processes; trends in the development of heat engines; have an idea of steam turbines, their types, structure and operation;
- The theory of technical thermodynamics; calculation of parameters of thermodynamic processes; construction and operation of steam boilers, steam turbines; heat transfer laws; be able to determine the design parameters of heat exchangers and make the right choice on an economical basis, calculate and use heat exchangers;
- have the ability to determine the design parameters of gas turbine units, internal combustion engines, compressor units and make the right choice on an economical basis, to calculate the operating condition;
- Technical-economic and theoretical analysis of student thermodynamic processes, heat engines; have the skills to design heat exchange systems to use them efficiently, determine optimal performance and operating conditions.

In addition, the bachelor:

- control of equipment performance and level of adverse effects in accordance with regulatory requirements;
- be able to effectively use protective equipment in cases of injury;
- development of measures to ensure cleanliness and safety in production activities;
- planning of measures to protect employees and the population in case of emergency;
- practical participation in emergency response and rescue operations, if necessary;
- first aid for victims of electric shock or other injuries;
- based on our national beliefs and values, the ability to use land, water, air and natural resources wisely, economically, any damage to nature can have extremely dangerous consequences for human life should be.

As a result of teaching this subject, the student should be able to determine the conditions that meet the requirements of life safety and environmental protection, and to perform the necessary calculations.

Relation of science to other sciences and production

To study the subject of "Thermodynamic Cycles of Power Plants" students must have sufficient knowledge of mathematics, physics, chemistry, drawing,

resistance of materials, theoretical and applied mechanics, heat and mass transfer, thermodynamics, thermal engineering.

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 learning aids, lecture notes, handouts and models are used in the study of the subject. Advanced pedagogical technologies such as CLUSTER, SYNCWINE, CASE-method, "Brainstorming", work in small groups ("Zig-Zag", "Corners") are used in lectures and practical classes.

Personalized education. In essence, this education involves the full development of all participants in the educational process. This means that when designing education, of course, the approach should be based not on the personality of a particular learner, but primarily on the learning objectives related to future professional activities.

Systematic approach. Educational technology should include all the features of the system: the logic of the process, the interconnectedness of all its components, the integrity.

An action-oriented approach. Represents education aimed at the formation of process qualities of the individual, the activation and intensification of the learner's activities, the discovery of all his abilities and capabilities, initiative in the learning process.

Dialogic approach. This approach emphasizes the need to build learning relationships. As a result, the individual's creative activity, such as self-activation and self-expression, increases.

Organize collaborative learning. Democracy, equality, and the need to focus on the introduction of collaboration in shaping the content of teacher and learner activities and evaluating the results achieved.

Problem-based learning. One of the ways to activate the learner is to present the learning content in a challenging way. It provides an independent creative activity of the objective contradiction of scientific knowledge and methods of its solution, the formation and development of dialectical observation, their creative application in practice.

Using modern means and methods of presenting information - the use of new computers and information technology in the educational process.

Teaching methods and techniques. Lecture (introduction, thematic, visualization), problem-based learning, case study, pinboard, paradox and design methods, practical work.

Forms of teaching: dialogue, polylogue, frontal, collective and group based on communication, collaboration and mutual learning.

Teaching aids: in addition to traditional forms of teaching (textbooks, lecture notes) - computer and information technology.

Methods of communication: direct interaction with the audience based on operational feedback.

Methods and means of feedback: observation, blitz-questionnaire, diagnostics of training based on the analysis of the results of intermediate and current, final control.

Methods and means of control: planning of lessons in the form of a technological map, which defines the stages of the lesson, the interaction of teacher and listener in achieving the set goal, not only in the classroom, but also independently outside the classroom control of affairs.

Monitoring and Evaluation: Systematic monitoring of learning outcomes, both in the classroom and throughout the course. At the end of the course, students' knowledge will be assessed using test assignments or written work options.

Distribution of lessons on the subject "Thermodynamic cycles of power plants" by topics and hour:

Academic semester	Course content					
	The lecture	Practical lesson	Laboratory work	Course work (project)	Independent study	Number of independent assignments
I. Full-time department						
V	20	16	-	-	24	1
Total	20	16	-	-	24	1

	The lecture	
1	History, development trends and modern composition of thermodynamics.	2
2	Classifications and characteristics of thermodynamic processes. Carnot cycle.	2
3	Cycles of steam turbine installations. Cycles of Renckin.	2
4	Operation of the turbine of the feed pump.	2
5	Design and classification of internal combustion engines	2
6	Compressors.	2
7	Jet engine cycles. (cycles of reactive engines)	2
8	Cycles of gas turbine plants	2

9	Cycles of combined-cycle plants	2
10	Refrigeration systems	2
	TOTAL	**20**
	Practical training	
1	Calculation of the basic thermodynamic processes	2
2	Tables and diagrams of water and steam	2
3	Carnot cycle and its efficiency	2
4	Cycles of steam turbine units and its efficiency	2
5	Cycles of gas turbine plants and its efficiency	2
6	Cycles of internal combustion engines and its efficiency	2
7	Compressors and its efficiency	2
8	Refrigerating plants and its efficiency	2
	TOTAL	**16**
	Independent work	
1	Calculation of gas cycles.	4
2	Determination of the characteristics of steam turbine plants.	4
3	Ideal piston compressors and its internal combustion engines.	4
4	The cycle of internal combustion engines with the input of heat to the working fluid with the volume supplied.	4
5	Cycle engines of internal combustion engines with the input of heat to the working fluid with the volume supplied.	4
6	Cycle engines of internal combustion with the input of heat to the working fluid at a post pressure.	4
	TOTAL	**24**

Information and methodological support of the program.

In the course of teaching this subject, the subject of labor protection, environmental protection, environmental laws, codes, Presidential Decrees and Decrees, Resolutions of the Cabinet of Ministers of the Republic of Uzbekistan, foreign and domestic literature, electronic literature, virtual laboratories, laboratory related technical equipment, various slides, wikipedias, articles in scientific journals, lecture texts, educational and methodical complexes on science and Internet materials are used.

III. Monitoring students' knowledge of science

About the system of monitoring and evaluation of student knowledge in higher education institutions

Regulation

This Regulation was approved by the President of the Republic of Uzbekistan on June 5, 2018 No. PP-3775 "On additional measures to improve the quality of education in higher education institutions and ensure their active participation in the ongoing comprehensive reforms in the country." Defines the

system of control and evaluation of students' knowledge in higher education institutions in accordance with the resolution "On".

Chapter 1 General rules

1. This Regulation shall apply to the control and assessment of the knowledge of students admitted to higher education institutions in the 2018-2019 academic year, as well as in subsequent academic years.

2. The requirements of this Regulation shall not apply to the control and assessment of students' knowledge in higher education institutions based on the modular system of the educational process in accordance with the legislation.

3. Students must be acquainted with the requirements of this Regulation in the first session by professors of higher education institutions.

4. In the assessment of students' knowledge, the evaluation criteria established by this Regulation shall be applied to qualification practice, course work, state (interdisciplinary) state certification, graduate work, as well as research and scientific-pedagogical work at the master's level and master's dissertation.

Chapter 2 Types of control and evaluation criteria

§ 1. Types of control

5. Monitoring of students' knowledge in higher education institutions is carried out through intermediate and final types of control.

6. Midterm examinations are conducted during the semester during the study period to assess the student's knowledge and practical skills after the completion of the relevant section of the working science program.

7. The type of intermediate control can be carried out up to 2 times for each subject, depending on the nature of the subject.

The form and duration of the midterm exam is determined by the relevant department, depending on the nature of the subject and the number of hours allocated to the subject.

8. Tasks of the intermediate type of control are developed by professors and teachers of the relevant department and approved by the head of the department.

9. There is no midterm exam in subjects less than 2 academic hours per week (4 academic hours in medical higher education institutions) during the semester.

10. The student's performance in practical, seminar, laboratory classes and independent study assignments, as well as his activity in these classes is assessed by the science teacher. The assessment is carried out on the basis of the criteria provided for in paragraph 15 of this Regulation.

In assessing the student by the type of midterm examination, the grades received during the study are taken into account.

11. The final type of control is carried out at the end of the semester (at the end of the subject in medical higher education institutions) to determine the level of acquisition of theoretical knowledge and practical skills of the student in the relevant subject.

12. The form of the final control is determined by the department of the relevant discipline.

13. The final type of control is carried out in accordance with the schedule of the final type of control, developed by the relevant dean of the faculty or educational-methodical department of the higher education institution and approved by the vice-rector for academic affairs.

14. Types of intermediate and final control in medical higher education institutions can be carried out in the form of objectively structured clinical trials or objectively structured examinations.

§ 2. Criteria for assessing student knowledge

15. Students' knowledge is based on the following criteria:

the student is able to make independent conclusions and decisions, think creatively, make independent observations, apply the acquired knowledge in practice, understand, know, express, tell the essence of the science (topic) and have an idea about the science (topic) - 5 (excellent) grades;

the student is able to observe independently, apply the acquired knowledge in practice, understand, know, express, tell the essence of the science (topic) and when it is found that he has an idea about the science (topic) - 4 (good) grade;

the student is able to apply the acquired knowledge in practice, understands, knows, expresses, tells the essence of the science (topic) and has an idea about the science (topic) - 3 (satisfactory) grade;

if the student has not mastered the science program, does not understand the essence of the science (topic) and has no idea about the science (topic) - 2 (unsatisfactory).

16. The content of the tasks on the types of control should provide an opportunity to assess the student's mastery objectively and objectively.

Regulations on the system of control and evaluation of student knowledge in higher education institutions

APPENDIX

Table 1

Rate the rating from a 5-point scale to a 100-point scale

SCHEDULE

5 price scale	100 point scale	5 price scale	100 point scale	5 price scale	100 point scale
5,00 — 4,96	100	4,30 — 4,26	86	3,60 — 3,56	72
4,95 — 4,91	99	4,25 — 4,21	85	3,55 — 3,51	71
4,90 — 4,86	98	4,20 — 4,16	84	3,50 — 3,46	70
4,85 — 4,81	97	4,15 — 4,11	83	3,45 — 3,41	69
4,80 — 4,76	96	4,10 — 4,06	82	3,40 — 3,36	68
4,75 — 4,71	95	4,05 — 4,01	81	3,35 — 3,31	67
4,70 — 4,66	94	4,00 — 3,96	80	3,30 — 3,26	66

4,65 — 4,61	93	3,95 — 3,91	79	3,25 — 3,21	65
4,60 — 4,56	92	3,90 — 3,86	78	3,20 — 3,16	64
4,55 — 4,51	91	3,85 — 3,81	77	3,15 — 3,11	63
4,50 — 4,46	90	3,80 — 3,76	76	3,10 — 3,06	62
4,45 — 4,41	89	3,75 — 3,71	75	3,05 — 3,01	61
4,40 — 4,36	88	3,70 — 3,66	74	3,00	60
4,35 — 4,31	87	3,65 — 3,61	73	3.0 and less	60 and less

BOOKS

1. S. Kleein., G. Nellis., Thermodynaies.Cambridge, 2012

2. Alimov M.M., Mavjudova SH.S., Isaxodjayev H.S., Rakhimjonov R.T., Umarjonova F.SH. Collection of experimental works on the subject "Theoretical foundations of thermal engineering". Methodological Manual, Part 1. –T .: ToshDTU. 2006

3. Umarjonova F.SH. Alimov MM, Mavjudova SH.S., Isakhodjayev H.S., Rakhimjanov RT, Collection of experimental works on the subject "Theoretical bases of thermal engineering". Methodological Manual, Part 2. –T .: ToshDTU. 2006

4.Zohidov R.A., Alimova M.M., Mavjudova Sh.S. Textbook "Thermal Engineering", T., National Society of Philosophers of Uzbekistan, 2010, -200 p.

5. Zohidov RA, Avezov RR, Vadiyashvili AB, Alimova MM, "Theoretical bases of thermal engineering", manual, part 1, TSTU, Tashkent, 2005.

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

7. Kudinov V.A., Kartashov E.M. Technical thermodynamics. - M .: Vysshaya shkola. 2005.

8. Koroli M.A. Methodical development of self-sustaining work in the discipline "Teplotexnika", - T., TashGTU, 2006.

9. 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

10. 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 II. TashGTU. Tashkent, 2007

11. Tsvetkov F.F., Grigorev B.A. Teplomassoobmen, - MEI., 2001

Electronic resources

www.gov.uz - Government portal of the Republic of Uzbekistan.
www.lex.uz - National Database of Legislation of the Republic of Uzbekistan.
www.Ziyo.net
http://www.rosteplo.ru:
http://www.abok.ru
www.bilim.uz - Website of the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan.