

Name of subject	Modeling energy-efficient devices and systems (ECTS 4)
Subject/module code	ETQTM1304
Science taught semester (s).	2 nd and 3 rd semesters
Responsible teacher	Abdullaev Elnur Akhmatovich, PhD., associate professor.
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	Total hours-120 Audience Training hours – 36 Lecture training hour – 18 Practical training hour – 18 Independent education -84 hours
ECTS	4
The purpose and tasks of subject / learning outcomes	<p>The purpose of teaching the subject is The main goal of the subject is to familiarize master's students with the basics of modeling energy-efficient devices and systems based on modern types, methods and programs; to introduce the types of modeling; to introduce the basics of modeling energy-efficient devices and systems using modern computer programs; to teach ways and methods to reduce energy consumption of industrial devices and systems based on modeling.</p> <p>The objective of the course “Modeling energy-efficient devices and systems” The task of the discipline is to prepare master's students to analyze practical issues, think independently, and make decisions by studying the types and methods of modeling energy-efficient devices and systems, to familiarize them with the scientific results achieved by Uzbek and foreign scientists in this field, and to draw attention to new pedagogical methods in foreign universities.</p> <p>Learning Outcomes:</p> <ol style="list-style-type: none"> 1. Familiarity with the basics of modeling energy-efficient devices and systems based on modern types, methods and programs; 2. The role and socio-economic importance of electricity in society; 3. Get to know the types of modeling; 4. Familiarity with the basics of modeling energy-efficient devices and systems using modern computer programs; 5. Studying ways and methods to reduce energy consumption of industrial devices and systems based on modeling; 6. Increasing the efficiency of electricity generation equipment; 7. Economic assessment of the competitiveness of traditional and unconventional methods of electricity generation; 8. Knowledge of and ability to use the main legal and regulatory documents available in the field.
Course content (topics)	<p>I. Main Theoretical Part (Lecture Sessions)</p> <p>Topics:</p> <ol style="list-style-type: none"> 1. Introduction. Purpose and objectives of science. Fundamentals and rules of modeling. Stages of modeling. 2. Informatics and information and communication technologies. Mathematical and physical modeling.. 3. Algorithm and algorithmization issues, construction of modeling algorithms. Programming systems. 4. Principles of energy and resource conservation. Electrical power and technological processes. 5. Energy model of the main power channel of an electric drive. 6. Characteristics and descriptions of widely used asynchronous motors. 7. Energy models of motors.

	<p>8. Principles of saving electricity, resources, and energy efficiency.</p> <p>9. Saving energy by limiting the duration of operation of the electric motor..</p> <p>II. Instructions and recommendations for organizing laboratory exercises.</p> <p>Laboratory work is not included in the curriculum</p> <p>III. Practical training instructions and recommendations</p> <p>The instructor's preparation for a practical session begins with the study of initial documents (such as the curriculum, topic schedule, etc.) and concludes with the development of a detailed lesson plan. The instructor must have a clear understanding of the objectives and tasks of the practical session, as well as the amount of work each student is expected to perform. Methodological guidelines serve as the primary instructional document for instructors in preparing and conducting practical sessions. The purpose of the practical session is to facilitate the comprehension of theoretical material, the acquisition of practical skills, the ability to consciously apply knowledge in academic and professional activities, and the development of critical thinking and confidence in forming personal viewpoints.</p> <p><i>Recommended Practical Topics:</i></p> <ol style="list-style-type: none"> 1. Formulate a technical task for modeling an object based on primary data. 2. Study the issues of assembling and calculating a model. 3. Create a mathematical model of an asynchronous motor. Formulate a calculation algorithm for an asynchronous motor 4. Model the frequency control of asynchronous motors. Model the transient processes of asynchronous motors. 5. Model the optimal dynamic modes of asynchronous motors using a computer. 6. Model the working processes of an autonomous inverter - asynchronous motor system. 7. Model a variable frequency asynchronous electric drive system. 8. Create a mathematical model of an asynchronous electric drive powered by a thyristor voltage regulator with speed feedback 9. Get acquainted with the Simulink program interface <p>IV. Independent learning and practical exercises</p> <p>Independent learning competency helps students to develop self-improvement skills and increase the efficiency of their professional activities. Students perform independent tasks on their mobile devices under the guidance of a teacher, either in traditional or electronic form.</p> <p>Recommended topics for practical exercises:</p> <ol style="list-style-type: none"> 1. Formulation of the technical task of modeling based on the primary data of the object 2. Familiarization with the Matkad program interface 3. Complete familiarization with the Simulink program interface. 4. Familiarization with the Sim Power System program interface. 5. Building models of Sim Power System Electrical Technological Devices and Systems. 6. Energy-efficient electromechanical devices and systems 7. Numerical modeling methods
Exam form	Written
Teaching/learning and examination requirements	<p>Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control.</p> <p>When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam</p>

	<p>questions for each discipline is discussed at the meeting and approved by the head of the department.</p> <p>No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean's office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean's office. After completion of the final work, the work is immediately encrypted by a representative of the Dean's office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform.</p> <p>The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers.</p> <p>Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.</p>
<p>Scope of assessment criteria and procedure</p>	<p>CURRENT CONTROL</p> <p>Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics.</p> <p>Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module-specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc.</p> <p>Current control form: Activity in lessons Preparing educational materials Working with sources within the subject Using educational technologies Working in a team Preparing presentations Working with projects.</p> <p>MIDTERM CONTROL</p> <p>Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course.</p> <p>Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject.</p> <p>INDEPENDENT LEARNING</p> <p>Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students.</p> <p>Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher.</p> <p>In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points</p>

	<p>allocated for current and intermediate control.</p> <p>FINAL CONTROL</p> <p>Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform.</p> <p>Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of "0-29.9" for this type of control is considered to be an academic debtor.</p> <p>Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.</p>				
Criteria for assessing student knowledge	5 grade	100 points		Assessment criteria	
	5	90-100	Excellent	When a student is considered to be able to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.	
	4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject.	
	3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.	
	2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.	
Course assessment criteria and procedure	Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
	Current assessment	30 points	System tasks	20 points (divided by the number of tasks)	18 points
			Student activity (in seminars, practical,	10 points	

			laboratory classes)		
	Midterm assessment	20 points	Supervision: Written work	10 points	12 points
			System tasks	10 points (divided by the number of tasks)	
	Final assessment	50 points	Written assignment (5 questions)	50 points (10 points per question)	30 points
	* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.				
Recommended Literature	<p>Main literature:</p> <ol style="list-style-type: none"> Браславский И.Я. и др. Энергосберегающий асинхронный электропривод-М.: Академия, 2004. Ильинский Н.Ф., Москаленко В.В. Электропривод электро- и ресурсо-сбережение. - М.: Издательский центр «Академия», 2008 - 208с. Карамайкин А. С. Моделирование процессов и систем: ГУ АП, 2005. - 110 с. Dadajonov T. Matlab asoslari. - Fargona: Texnika, 2008. - 631 b. Muxitdinov M., Dadajonov T. Virtual laboratoriya. -Toshkent.: Fan, 2009. - 579 b. Xashimov A.A., Mirisayev A.U., Kan L.T. Энергосберегающий асинхронный электропривод. Monografiya. - Tashkent: Fan va texnologiya, 2011. - 132 s. Хамудханов М.М. Математическое моделирование насосной установки систем электромашиного орошения // Вестник ТашГТУ, 2011. № 1-2. - С. 53-58. Хамудханов М.М. Насосная станция систем машинного водоподъема как объект управления энерго- и ресурсосбережением // Журнал - Вестник ТашГТУ. - Т., 2013. № 2. С.67-73 Шрейнер Р.Т. Математическое моделирование электроприводов переменного тока с полупроводниковыми преобразователями частоты. Екатеринбург.: 2000. - 654 с. <p>Additional literature:</p> <ol style="list-style-type: none"> Mirziyov Sh.M. Tanqidiy tahlil, qat'iy tartib-intizom va shaxsiy javobgarlik – har bir rahbar faoliyatining kundalik qoidasi bo'lishi kerak. O'zbekiston Respublikasi Vazirlar Mahkamasining 2016 yil yakunlari va 2017 yil istiqbollariga bag'ishlangan majlisidagi O'zbekiston Respublikasi Prezidentining nutqi. // Xalq so'zi gazetasi. 2017 yil 16 yanvar, №11. Mirziyoyev Sh.M. Erkin va farovon, demokratik O'zbekiston davlatini birgalikda barpo etamiz. O'zbekiston Respublikasi Prezidentining lavozimiga kirishish tantanali marosimiga bag'ishlangan Oliy Majlis palatalarining qo'shma majlisidagi nutqi. –T.: “O'zbekiston” NMIU, 2016. – 56 b. Mirziyoyev Sh.M. Buyuk kelajagimizni mard va olijanob xalqimiz bilan birga quramiz. - T.: “O'zbekiston” NMIU, 2017. – 488 b. Эфимов А.А. Обобщенный подход к моделированию систем электропривода переменного тока. Вестник Красноярского государственного университета. - Красноярск.: 1998. с. 172-182. 				

14. The Beginne's Guide to Engineering: Mechanical Engineering, 2013 by Mark Huber.
15. The Electric Power Engineering Handbook, Third Edition - Five Volume Set (Electrical Engineering Handbook), 2012 by Leonard L. Grigsby.
16. M.M. Khamudkhanov. Formal model of water elevating pump installation and research on influence of a number of factors on power efficiency of its functioning.// Seventh World Conference on Intelligent Systems for Industrial Automation, WCIS -2012. P 115-121.
17. M.M. Khamudkhanov. Resource-Saving Model for Formation of Water Consumption Schedule For Seed Culture of Irrigated Agrolandscapes.// The III International Conference on Multimedia Information Technology and Applications (MITA - 2015). P 433-437.
18. Хамудханов М.М. Формирование энергосберегающей режимной карты, функционирования насосной станции систем машинного водоподъема // Проблемы энерго- и ресурсосбережения, 2012. № 1-2. - С. 136- 143.
19. Кадиров А.А., Хамудханов М.М. Методы исследования и расчета энерго- ресурсосберегающих режимов работы водоподъемных насосных станций. -Т: «Янги аср авлоди», 2013. - 120 с.
20. Сипайлов Г.А., Лоос А.В. Математическое моделирование электрических машин. - М.: Высшая школа, 1980. - 176 с.

Internet sites:

21. www.gov.uz –Government portal of the Republic of Uzbekistan.
22. www.catback.ru – international scientific articles and educational materials website.
23. www.google.ru – international educational materials search website.
24. www.ziyonet.uz – national educational materials search website.
25. www.lex.uz – national database of legal documents and information.
26. www.catback.ru – scientific articles and educational materials