



Module Handbook

for the degree program

ELECTRICAL ENGINEERING

(Direction: Bachelor)



Almaty, 2020-2022

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Curriculum of graduate studies 6B07101 - Electrical Engineering







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| **Module name** | **MEE -В1 Modern history of Kazakhstan** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Associate Professor Baidildina Fellan Saule |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; practical classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | General education school program of the history of Kazakhstan course, world history and geography. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to give students scientifically based objective knowledge on the history of their native country from the beginning of the twentieth century to the present day, to form a sense of pride in their Homeland, belonging to its history, continuity of generations. To reveal the political, economic, ethnic, social and cultural content of the modern history of Kazakhstan in the context of world history and the history of Eurasia.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main stages and periods of the modern history of Kazakhstan from the twentieth century to the present day;  - basic historical facts, dates, names, turning points in the fatherland history;  - names of historical figures of Kazakhstan, their contribution and role in the history of the country;  - the place of the history of modern Kazakhstan in the world history and history of Eurasia  **are able to:**  - independently work with various historical sources, as well as with textbooks, electronic textbooks, Internet sources, periodicals, maps, diagrams, etc.;  - acquire research skills.  **COMPETENCES:**  - demonstrate the skills to correctly express the acquired knowledge in oral speech and in writing;   * - able to diversify and critically analyze historical and contemporary sources, draw conclusions, argue them. |
| **Content** | The modern history of Kazakhstan is part of the history of all mankind, which is naturally get involved into the world history context, the history of Eurasia and the countries of Central Asia. In the course of the modern history of Kazakhstan study, multifaceted political, ethnic, social and economic, spiritual and cultural aspects of the most important events and phenomena on the territory of modern Kazakhstan from the beginning of the 20th century to the present day are revealed.  The twentieth century is one of the most important periods in the historical fate of our people. The history of the twentieth century is filled with social and political and cultural contradictions, political and economic transformations.  The course study forms and develops students' national self-consciousness, civic unity, a sense of pride in their Fatherland, engagement with its history, which is the main core of Kazakhstani patriotism. |
| **Current control** | Semester works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC |
| **References** | 1. История Казахстана. В 5-ти томах. 3- 5 тома. Алматы: Атамұра, 2000., 2010. 2. Аяган Б., Ауанасова А., Сулейменов А. Новейшая история Казахстана: Кризис и распад советской системы. I том: Научно-популярное издание. Сер. «Летопись независимости». - Алматы: ТОО «Литера-М», 2011. 3. Аяган Б.  Новейшая история Казахстана. 2 том: Выход из кризиса/ Б. Аяган; Ауанасова А., Кудайбергенов Р.- Алматы: ТОО «Литера-М», 2011. 4. Аяган Б.  Новейшая история Казахстана. 3 том: Устойчивый Казахстан / Б. Аяган;Ауанасова А., Сулейменов А.- Алматы: ТОО «Литера-М», 2011. 5. Артыкбаев Ж.О.; Раздыков С.З. История Казахстана: Учебник. – Астана: Фолиант, 2007. 6. Акимбеков С., Казахи между революцией и голодом / С. Акимбеков. - Алматы : Институт Азиатских исследований, 2021. - 584 с. |

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| **Module name** | **MEE -В2 Foreign language 1**  **MEE -В9 Foreign language 2** |
| **Semester(s) in which the module is taught** | 1, 2 |
| **Person responsible for the module** | Zussupova Akbota Utepbergenovna |
| **Language** | English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Practical classes |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 300 hours  **Class hours:**  Practical classes - 90; SSW –198 (SSTS -30)  **Contact hours for exams:** 12 |
| **Credits** | 10 |
| **Required and recommended prerequisites for joining the module** | Depending on the level of the group, basic, advanced knowledge of English, obtained in high school. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Teaching practical knowledge of colloquial speech and the language of specialty for the foreign language active use, both in everyday and professional communication.  **LEARNING OUTCOMES:**  **Bachelors know:**  - the rules of word formation;  - contextual meaning of polysemantic words;  - the most common specific grammatical phenomena.  **are able**:  - to read texts with and without a dictionary, find the given information, memorize the content of what was read;  - translate general technical texts from a foreign language into a native language using a dictionary;  - understand foreign language.  **COMPETENCES:**  - the ability to express thoughts and express one's opinion in a foreign language in accordance with the language speech norms;  - ability to read and understand technical literature in a foreign language;   * - the ability to ask questions and answer them, maintain a conversation in a foreign language, adequately use communicative utterances, retell the content of what has been read. |
| **Content** | A foreign language course is one of the most important courses that lays the foundation for the skills and abilities formation that allow first-year students to speak, read and understand a foreign language at a certain level. |
| **Current control** | Semester assignments 6, Midterm control 1.2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, course books, audio-video materials. |
| **References** | 1. Orlovskaya I.V., Samsonova L.S., Skubriyeva А.I. Uchebnik angliskogo yazyka dlya tehicheskih universitetov I vuzov. – 16-izd., stereotip.-М: Izd-vo MGTU im. N.E. Baumana, 2020. – 446s. 2. Litvinskaya S. S., Angliski yazyk dlya technicheskih specialnostei: ucheb. posobiye / S.S. Litvinskaya. - М: Infra-М, 2021. - 252 s. - (Secondary vocational education) 3. Essential Grammar in Use. Murphy Raymond. Cambridge University Press, 2017. 4. Zhussupova А. U. English language. Methodical guidelines for the development of listening skills based on texts (for students of 050717, 050718 specialties) - 2012. 5. Sergeyeva L.D. English language. Guidelines for the development of perception skills based on video materials (for all specialties) - 2012.   Nurguzhina G.М., English-Russian-Kazakh dictionary Англо-русско-казахский glossary of information technology terms / G.М. Nurguzhina, S.А. Kudubayeva, G. D. Kogai. - Almaty: New Book, 2020. - 160 p. |

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| **Module name** | **MEE -В3 Kazakh language 1. Level B2**  **MEE -В10 Kazakh language 2. Level B2** |
| **Semester(s) in which the module is taught** | 1,2 |
| **Person responsible for the module** | Associate professor Tuleup Meirimkul Mukhamediyarovna |
| **Language** | Kazakh |
| **Relation to curriculum** | Compulsory |
| **Teaching methods** | practical classes, semester work, self-study work of a bachelor under the teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 300 hours  **Class hours:**  Practical classes - 90; SSW –198 (SSTS -30)  **Contact hours for exams:** 12 |
| **Credits** | 10 |
| **Required and recommended prerequisites for joining the module** | The Kazakh language in Russian school |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of a linguistic personality, competitive in the modern labor market, able to express their opinion orally and in written form in the state language, based on communicative approach according to the skill level of students.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the basic Kazakh language grammatical structure;  - general rules of word formation;  - basic syntactic constructions;  **Are able:**  - to participate in communicative, informational and social-cultural situations, maintain the dialogue, participate in discussions.  - systematically express thoughts on the given topics;  - compose texts (essays, descriptions, annotations) in accordance with the language speech norms, functional orientation, lexical and grammatical material and pragmatic factors  **COMPETENCES:**  - interpretation of text information, style and genre features in accordance with the social-cultural, social-political, official business and professional spheres of communication;  - discuss ethical, cultural, socially significant issues, express their own point of view, defend it with arguments, critically evaluate the opinion of interlocutors;   * - compilation of everyday, social-cultural texts, taking into account generally accepted norms, functional orientation, lexical and grammatical material and pragmatic factors |
| **Content** | Educational materials aimed at the state language communication skills and abilities development in the interpersonal, social, professional, intercultural communication areas in the context of the spiritual modernization of the national consciousness are considered.  The discipline is implemented on the basis of the language proficiency appropriate level of the Common European Competences scale. The general education cycle discipline (general education disciplines) is designed for the Russian department students of the university (bachelor's degree). The discipline is basic and belongs to the "Language Training" module. |
| **Current control** | Semester work 6, midterm control 4, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC |
| **References** | 1. Abduova B. S., Asanova U. O. Kazakh language: a textbook for Russian-speaking groups. - Astana, p. 2017. -282.  2. Aitbayeva B. M. textbook of the Kazakh language (level B2). Karaganda, p. 2014. – 205.  3. Balabekov A. K., Bozbayeva-Hung A. T., Dosmambetova G. K., Salykhova B. O., Khazimova A. Zh.. Kazakh language: textbook for the above-average level. National Testing Center. - Astana: 2017.  4. Bozbayeva-hung A. T., Balabekov A. K., Dosmambetova G. K., Salykhova B. O., Khazimova A. Zh. Kazakh language: textbook for the secondary level. National Testing Center. - Astana: 2017.  5. Zhekeeva K. O. Kazakh language (level B2). Textbook (for students of technical universities) - Almaty: AUPET, 2019. https://drive.google.com/file/d/1pb09TIqwU4ru60Cdr3BVDqVX14kIiecR/view?usp=sharing  7. Kuzekova Z. S., Baitelieva Zh.D. Kazakh language: textbook for the secondary level. - Astana, 2016.  8. Kuzekova, Z. S. functional practical grammar of the Kazakh language: a textbook. - Astana: Folio, 2015. – p. 180.  9. Kazakh language (for language learners at levels B1 and B2): a textbook for Russian-speaking groups./ K. S. Kulmanov, B. S. Abduova, etc. - Astana: - 2015. – p. 298.  10. Kazakh language: the main textbook of the level educational and methodological complex( basic level) / zh.K. Tuimebayev, K. Kadasheva, U. O. Asanova. - Almaty, 2013. – p. 208 .  11. Karabayeva H. A. Kazakh language: textbook. - Almaty: Kazakh University, 2014.  12. Kulmanov K. S., Abduova B. S. Kazakh language (for language learners at levels B1 and B2): textbook for Russian - speaking groups-Astana: ENU. - 2015. – p. 298.  13. Salkinbay A. B., Egizbayeva N. Zh. Kazakh language. Basic level: training manual. - Almaty: Kazakh university, 2017.  14. Salkinbay A., Egizbayeva N., Zhumagulova A., Imankulova S., Rysbay B. Kazakh language: textbook. - Almaty: Kazakh university, 2016.  15. “Digital educational resources” for students studying in the Russian department, depending on the subject “Kazakh language-I” and “Kazakh language-II”. - Astana, 2014.  16. Arystangalieva D. M. Kazakh language. Level B2. Methodological guide on tasks of independent work of students for all educational programs-Almaty: AUPET named after Gumarbek Daukeyev, 2020. - 31 p.  17. Toleup M. M., Sovetova Z. S. Kazakh language. Textbook for students of technical educational institutions. - Almaty: Aues, 2015. – p.198. <http://libr.aues.kz/facultet/eef/kaf_rkj/1/umm/kya_56.pdf>  18. Sharibzhanova G. Kazakh language. A collection of exercises and tasks for technical universities. Training manual. - Almaty, 2012. – p. 87. |

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| **Module name** | **MEE -В3 Russian language 1. Level В1**  **MEE -В10 Russian language 2. Level В1** |
| **Semester(s) in which the module is taught** | 1,2 |
| **Person responsible for the module** | Associate professor Dosmahanova Raikul Amandykovna (rus. lang.) |
| **Language** | Russian |
| **Relation to curriculum** | Compulsory |
| **Teaching methods** | practical classes, semester work, self-study work of a bachelor under the teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 300 hours  **Class hours:**  Practical classes - 90; SSW –198 (SSTS -30)  **Contact hours for exams:** 12 |
| **Credits** | 10 |
| **Required and recommended prerequisites for joining the module** | The Russian language in Kazakh school |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of the social-humanitarian worldview of students in the context of the national idea of spiritual modernization, which involves the development of internationalism qualities, tolerant attitude towards world cultures and languages as translators of the world-class knowledge, advanced technologies, the use and transfer of which can ensure modernization of the country on the basis of national consciousness and cultural code and personal career growth of future specialists.  **LEARNING OUTCOMES:**  **Bachelors know**:  - compositional and semantic organization features of the text in Russian;  - basic techniques for the main information extraction of the microtext;  - principles of texts compiling on a given lexical topic.  **are able**:  - to formulate a topic, determine the language means of the text organizing and use them in their own speech production;  - to extract the necessary information from the primary source (mass media, official documents, works of art and specialty scientific literature), describe, summarize, and interpret it for educational purposes.  **COMPETENCES:**  - to carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition on the basis of sufficient amount of vocabulary knowledge, a system of grammatical knowledge, pragmatic means of expressing intentions;  - to request and communicate information according to the communication situation, evaluate the actions and deeds of participants, use information as an influence tool to the interlocutor in cognition and communication situations in terms of level B1certification requirements;  - to participate in different spheres of various communication situations in order to realize their own intentions and needs (everyday, educational, social, cultural), declaring them correctly, meaningfully complete, lexically - grammatically and pragmatically adequate to the situation; |
| **Content** | The educational materials on cognitive and communicative activity in Russian language in the spheres of interpersonal, social, professional, intercultural communication are considered in the context of the state trilingual programs implementation and the spiritual modernization of national consciousness. The discipline is implemented on the appropriate proficiency language level basis of the OEK scale. The discipline of the general education cycle (GED) is designed for the Kazakh department university students (bachelor degree). The discipline is basic and refers to the "Language training" module. |
| **Current control** | Semester work 6, midterm control, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer |
| **References** | 1 Bukeikhanovа R.K., Musabaeva Z.T. Practical course of the Russian language. Textbook / R.K. Bukeikhanov, Z.T. Musabayeva. - Almaty: Gumarbek Daukeev AUES, 2021. - 77 p. - URL: <http://libr.aues.kz/facultet/101_TEF/142_Kafedra_yazikovih_znaniy/593_Prakticheskiy_kurs_russkogo_yazika/DRLQJVg6eCFYKx7MmfdotjuHs2AWE4.pdf>  2 Dosmakhanova R.A. Russian language. Level B1: A textbook for students of technical universities. Part I/R.A. Dosmakhanova. - Almaty, 2021– - 131 p.  3 Evtyugina A.A. Russian language and culture of speech: a course of lectures [Electronic resource]: textbook. - Yekaterinburg: Russian State Prof.-ped. un-t, 2019– - 269 p. - URL: <http://elar.rsvpu.ru/978-5-8050-0669-3>  4 Ermachenkova V.S. We repeat cases and prepositions: a correction course for students of Russian as a second language (electronic edition). - 3rd ed. - St. Petersburg : Zlatoust, 2014. - 172 p. − URL: <https://yadi.sk/i/ObYeDABXjks_3g>.  6 Leventhal I.V. et al. Russian language tests: B1. Open examination materials of St. Petersburg State University. - St. Petersburg: Zlatoust, 2020. - 140 p. 7 Multilingual website for learning Russian. – URL: https: // russky.info/ru  8 The National Corpus of the Russian language. – URL: [www.ruscorpora.ru](http://www.ruscorpora.ru)  9 Nurmakhanova M.K. Russian language for technical specialties of universities: Textbook. - Almaty: AUES, 2018. - 156 p. - URL: <http://libr.aues.kz/facultet/101_TEF/142_Kafedra_yazikovih_znaniy/406_Russkiy_yazik_dlya_tehnicheskih_spetsialnostey_vuzov/x2Si3D9f87NpzGTKIo5brdPO4uJQC1.pdf>  10 Portal of the state language of the Republic of Kazakhstan (bilingual industry dictionaries). – URL: [www.til.gov.kz/wps/portal](http://www.til.gov.kz/wps/portal)  12 Russian language. Textbook for students of Kazakh departments of universities (bachelor's degree)/ Ed. Akhmedyarova K.K., Zharkynbekova Sh.K., Mukhamadieva H.S. - Almaty: Kazakh University, 2012. - 226 p. − URL: <https://edu.semgu.kz/ebook/umm/10b7f6c6-bf4f-11e4-bd4b-.pdf> |

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| **Module name** | **MEE -В4 Mathematics 1** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Kaz Assoc. prof. Iskakova Akzholtay Kurmantaevna, prof. Baisalova Manshuk Zhumamuratovna  Rus Assoc. prof. Masanova Aida Zhailauovna, Assoc.prof. Vasilina Gulmira Kazhymuratovna  Eng Assoc.prof. Kim Regina Evgenievna |
| **Language** | *Kaz/rus/eng* |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory, university component |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15; Practice - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | School Fundamentals of microprocessor technology course |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  build mathematical models, set mathematical problems, use the basic methodological principles for solving mathematical problems, generalize computational and theoretical material based on the methodology of modern Fundamentals of microprocessor technology.  **LEARNING OUTCOMES:**  **Bachelors know:**  - basic concepts of linear algebra and analytic geometry;  - basic fundamental concepts of mathematical antheory of limits; theory of continuous functions of one variable;  - differential calculus of a function of one real variable; indefinite and definite integrals and their applications;  **are able to:**  - apply matrices and determinants in solving systems of linear equations; find the limit of sequences and functions at a point;  - explore the function using the derivative and build a graph of the function; apply various methods when calculating integrals;  - find optimal methods for solving mathematical problems;  **COMPETENCES:**  - to demonstrate the skills of creative thinking, independent, cognitive activity;   * - the ability to apply acquired knowledge for the practical implementation of engineering tasks; |
| **Content** | The fundamentals of linear algebra, analytic geometry and complex numbers, systems of two and three linear equations with two and three unknowns, differential calculus of functions of one variable, integral calculus of functions of one variable are outlined.  The main properties of determinants, matrices, second-order curves are studied as well as functions that have a limit, functions that are continuous on a segment, derivatives and integrals. |
| **Current control** | Calculation and graphic works- 3, Midterm control 2, tests. |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software. |
| **References** | 1. Bugrov Ya.S., Nikolskii S. M. Higher Fundamentals of microprocessor technology. V.2, Elements of linear algebra and analytic geometry. Moscow, URAIT 2020, 282 p.  <https://urait.ru/viewer/vysshaya-matematika-v-3-t-t-2-elementy-lineynoy-algebry-i-analiticheskoy-geometrii-449950#page/1>  2. Bugrov Ya.S., Nikolsky S.M. Higher Fundamentals of microprocessor technology. T.1, Differential and integral calculus. Moscow, "URAIT" 2016, 503 p.  <https://urait.ru/viewer/vysshaya-matematika-v-3-t-t-1-v-2-knigah-differencialnoe-i-integralnoe-ischislenie-388586#page/1>  3. Pismennyi D.T. Lectures notes on higher Fundamentals of microprocessor technology. 1 part. – M.: Rolf, 2007. – 288 p.  4. Individual tasks in higher Fundamentals of microprocessor technology: Part 1 Linear and vector algebra. Analytic geometry. Differential calculus of a function of one variable / ed. A.P. Ryabushko - Mn .: Vysh. school, 2007.-304 p.  5. Individual tasks in higher Fundamentals of microprocessor technology: Part 2 Complex numbers. Indefinite and definite integrals. Functions of several variables Ordinary differential equations / ed. A.P. Ryabushko - Mn .: Vysh. school, 2007.-304 p.  6. Mustakhishev K.M., Atabay B.Zh. Fundamentals of microprocessor technology 1. Lecture notes for students of 5B071700 “Heat power engineering”, 5B071800 “Power engineering”, 5B071900 “Radio engineering, electronics and telecommunications” specialties. - Almaty AUPET, 2013 - 48 p.  http://libr.aues.kz/facultet/frts/kaf\_vm/12/umm/vm\_9.htm  7. Toleuova B.Zh. Fundamentals of microprocessor technology 1: Guidelines and assignments for the implementation of calculation and graphic work for students of all degree programs. - Almaty: AUES, 2020. - 67 pages.  <https://libr.aues.kz/facultet/104_FIT/137_Kafedra_matematiki_i_matematicheskogo_modelirovaniya/246_Matematika_1/CjxPEgfUDRO6MwQvprthmayZkJBzST.pdf> |

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| **Module name** | **MEE -В5 Philosophy** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Cand.Phil.Sc, Professor Mukhamedzhan Kuanysh Shakirtovich (Kaz.)  Cand.Phil.Sc, Associate Professor Abrakhmatova Gulnara Abraykulovna (Russian, English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, semester works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Philosophy, Sociology, Culturology, Psychology cultural studies |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** the formation of a basic system of philosophical knowledge among students, the development of a philosophical way of thinking in relation to the general picture of the world, the complex relationships of life reality, the values of human existence, mastering the principles of a rational philosophical approach to the processes and trends of the modern information society.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main directions of philosophical thought;  - the dialectic of personality formation, its freedom and responsibility, the originality of the intellectual, moral and aesthetic experience of different historical eras  **are able**:  - substantiate the worldview as a product of philosophical reflection and study of the natural and social world;  - substantiate the role and significance of key worldview concepts as values ​​of the social and personal existence of a person in the modern world;  - to formulate and competently argue their own moral position in relation to the actual problems of modern global society;  - conduct research that is relevant to identify the philosophical content of problems in the professional field and present the results for discussion.  **COMPETENCES:** - knowledge and understanding of the laws of development of nature, society and thinking and the ability to operate with this knowledge in professional activities;  - the ability to take an active civic position, the ability to analyze and evaluate historical events and processes;  - possession of a culture of thinking, the ability to perceive, generalize and analyze information, set a goal and choose ways to achieve it, the ability to logically correctly, reasonably and clearly build oral and written speech. |
| **Content** | The discipline program is aimed at developing students' openness of consciousness, understanding of their own national code and national identity, spiritual modernization, competitiveness, realism and pragmatism, independent critical thinking, the cult of knowledge and education, the assimilation of such key worldview concepts as justice, dignity and freedom, as well as the development and strengthening of the values of tolerance, intercultural dialogue and a culture of peace |
| **Current control** | Semester works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | 1 Масалимова А. Р., Алтаев Ж. А., Касабек А.К. «Казахская философия». Учебное пособие. – Алматы, 2018.  2 Светлов В. А., История философии: учеб. пособие / В.А. Светлов. - 2-е изд., испр. и доп. - М.: Юрайт, 2020. - 176 с. - (Высшее образование)  3.Спиркин, А. Г. Философия для технических вузов : учебник / А.Г. Спиркин. - М. : Юрайт, 2020 |

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| **Module name** | **MEE-В6-1 Introduction to the specialty** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | senior teacher Agimov Talgat Nurlanovich (kaz)  senior lecturer Zhivaeva Olga Petrovna (rus) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Introduction to electrical engineering" |
| **Teaching methods** | Lectures, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-30; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | subjects of a general education school |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  familiarization with energy resources and energy systems, with various methods of generating electricity.  **LEARNING OUTCOMES:**  **Bachelors know**:  - operating modes of electrical installations;  - classification of electrical load curves;  - principles of operation of various types of power plants;  - new ways of power transmission;  - element base of relay protection.  **are able**:  - to determine the methods of obtaining electricity from various energy sources.  - choose the category of power supply reliability.  **COMPETENCES**: - have an understanding of modern electric power systems and electrical equipment. |
| **Content** | The main patterns of phenomena and processes on which the modern electric power industry is based are outlined; on the basis of these ideas, the device, principles of operation, modes of operation of power generating equipment are explained; covers all issues related to the production, transmission and distribution of electrical energy.  Information is given on the electrical circuits of power plants and substations, power supply systems, electrical machines of power plants, transformer equipment, high voltage switching and protective devices, relay protection, general ideas about hydropower and renewable energy sources. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | 1. Немировский А. Е., Электрооборудование электрических сетей, станций и подстанций: учеб. пособие / А.Е. Немировский, И. Ю. Сергиевская, Л. Ю. Крепышева. - 4-е изд., доп. - М: Инфра-Инженерия, 2020; Вологда. - 174 с.:ил., табл. 2. Лыкин А. В., Электроэнергетические системы и сети: учебник для вузов / А.В. Лыкин; Новосибирский государственный технический университет. - М.: Юрайт, 2020. - 360 с. - (Высшее образование) 3. Агафонов А.И., Современная релейная защита и автоматика электроэнергетических систем : учеб. пособие / А.И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с. 4. Юдаев И. В., Возобновляемые источники энергии : учебник / И.В. Юдаев, Ю.В. Даус, В.В. Гамага. - 2-е изд., стер. - СПб. : Лань, 2021. - 328 с. 5. Быстрицкий Г.Ф., Электроснабжение. Силовые трансформаторы : учеб. пособие для академического бакалавриата / Г.Ф. Быстрицкий, Б.И. Кудрин. - 2-е изд., испр. и доп. - М. : Юрайт, 2019. - 201 с. - (Университеты России) |

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| **Module name** | **MEE-В6-2 Introduction to electrical engineering** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | senior teacher Agimov Talgat Nurlanovich (kaz)  senior lecturer Zhivaeva Olga Petrovna (rus) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Introduction to the specialty" |
| **Teaching methods** | Lectures, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-30; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | subjects of a general education school |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  familiarization with the basics of the electric power industry, with general information about the transmission and distribution of electric energy.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main technical means of transmission, transformation and consumption of electricity;  - types of graphs of electrical loads;  - basic principles of power supply;  - main types of alternative energy sources;  - bases of relay protection.  **are able**:  - to determine the methods of obtaining electricity from various energy sources.  - choose the category of power supply reliability.  **COMPETENCES**: - have an idea of the importance of energy in technical progress.. |
| **Content** | The characteristics of electric power systems are considered, information is provided on the main technical means of transmission, transformation and consumption of electricity. Devices based on the use of renewable energy sources are being analyzed. Information is given about the assignment of functions to the composition of an automated drive, its role in modern machine technologies. The basic principles of designing the power supply system, general information about the power supply of industrial enterprises and populated areas are given. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | 1.Немировский А. Е., Электрооборудование электрических сетей, станций и подстанций: учеб. пособие / А.Е. Немировский, И. Ю. Сергиевская, Л. Ю. Крепышева. - 4-е изд., доп. - М: Инфра-Инженерия, 2020; Вологда. - 174 с.:ил., табл.  2.Лыкин А. В., Электроэнергетические системы и сети: учебник для вузов / А.В. Лыкин; Новосибирский государственный технический университет. - М.: Юрайт, 2020. - 360 с. - (Высшее образование)  3.Агафонов А.И., Современная релейная защита и автоматика электроэнергетических систем : учеб. пособие / А.И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.  4. Юдаев И. В., Возобновляемые источники энергии : учебник / И.В. Юдаев, Ю.В. Даус, В.В. Гамага. - 2-е изд., стер. - СПб. : Лань, 2021. - 328 с.  5.Быстрицкий Г.Ф., Электроснабжение. Силовые трансформаторы : учеб. пособие для академического бакалавриата / Г.Ф. Быстрицкий, Б.И. Кудрин. - 2-е изд., испр. и доп. - М. : Юрайт, 2019. - 201 с. - (Университеты России) |

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| **Module name** | **MEE -В7, MEE -В14, MEE -В18, MEE-В23 Physical education** |
| **Semester(s) in which the module is taught** | 1,2,3,4 |
| **Person responsible for the module** | Teacher Turarov Erzhan Zhanatovich |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Practical seminars, Bachelor’s self-study work under teacher’s supervision (SSTS), reach a qualifying standard |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 120 hours  **Class hours:**  Practice - 30; SSW – 78  **Contact hours in preparation for exams: differentiated credit 12** |
| **Credits** | 8 |
| **Required and recommended prerequisites for joining the module** | No |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of general cultural competencies: the ability to use methods and means of physical culture to ensure a full-fledged social and professional activity.  **LEARNING OUTCOMES:**  **Bachelors know:**  -the basic principles and content of general, special and applied physical training  - the functional body state and the physical activity adjustment to achieve the proper level of physical fitness  **are able:**  - to apply a practical skills system that ensures preservation and strengthening of health and, the development and improvement of individual qualities and properties;  - to form motivational and values-based attitude to physical culture and sports, focusing a healthy lifestyle, physical self-improvement and self-education, the need for regular exercise and sports.  **COMPETENCES:**  - the ability to apply normative documents in practice, to be guided by them when solving sports issues;   * - organize and apply knowledge of theoretical and practical foundations of physical culture, sports, and a healthy lifestyle; |
| **Content** | Solution of educational, developmental and recreational tasks:  • formation of awareness of the physical culture and sports social role in the individual development, preparing for life and professional activities;  • formation of a motivational and values-based attitude to physical culture and sports, focusing a healthy lifestyle, physical self-improvement and self-education, the need for regular exercise and sports.  • mastering of the practical skills system that ensures the preservation and strengthening of students' health, the development and improvement of the individual qualities and properties. |
| **Current control** | Standards, Midterm control 2, presentation work |
| **Final control** | Graded test |
| **Study and examination requirements** | Gym, sports equipment |
| **References** | 1. Теория и методика обучения предмету "физическая культура". Водные виды спорта. Учебное пособие / под ред. Булгакова Н. Ж. М.: Юрайт, 2019. 304 с. 2. Чернов И.В., Ревунов Р.В. Организация учебно-тренировочного процесса по физической культуре в высшем учебном заведении (на примере тяжёлой атлетики). М.: Лань, 2019. 104 с. 3. Элективные курсы по физической культуре. Практическая подготовка / под ред. Зайцев А. А. М.: Юрайт, 2020. 228 с. |

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| **Module name** | **MEE -В8 Physics 1** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | PhD Nysanbayeva S. K. (Kazakh)  Associate Professor Associate Professor Salamatina A. M. (Russian, English) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** development of natural-science outlook; formation of a fundamental basis for the study of general technical and special disciplines and for successful subsequent professional activity; the formation of students' skills and abilities to use fundamental physical laws and theories, as well as methods of physical research..  **LEARNING OUTCOMES:**  **Bachelors know**:  - basic physical theories, principles, laws and limits of their applicability;  **are able**:apply theoretical knowledge to solve specific physical problems and situations; analyze the results of a physical experiment, simulate physical situations.  **COMPETENCES:** organizing and conducting a simple physical experiment;  work with modern measuring devices;. |
| **Content** | Fundamentals of molecular kinetic theory, thermal processes in gases, thermodynamic reversible and irreversible processes, quantum statistics and their applications. Basic equation of state of an ideal gas, isoprocesses, three principles of thermodynamics, heat engines and their efficiency |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Physics 1. Дәрістер жинағы. 6В07101 – Электр энергетикасы мамандыќтарының студенттеріне арналған. Алматы, АУЭС, 2020.  2. Алджамбекова Г.Т., Наурызбаева Г.К. Physics 1\_«6В07101 –Электроэнергетика» мамандығының студенттеріне арналған ЕСЖ орындау бойынша әдістемелік нұсқаулар. АЭжБУ, 2020.  3. Павлов С. В., Общая Physics : сборник задач: учеб. пособие / С.  В. Павлов, Л.А. Скипетрова; под ред. С. В. Павлова. - М. : ИНФРА-М, 2021: ИНФРА-М, 2021. - 319 с. - (Высшее образование: Бакалавриат)7.  4. Байпақбаев Т.С., Қарсыбаев М.Ш., Сыздықова Р.Н. Статистикалық Physics және термодинамика. Барлық мамандықтардың студенттері үшін зертханалық жұмыстарды орындауға арналған әдістемелік нұсқау. - Алматы: АЭжБУ, 2011. -34 б.  5. Электростатика.Тұрақты ток [Мәтін] : зертханалық жұмыст.орынд.арн-н әдіст.нұсқаулар / КЕАҚ АЭжБИ, Physics каф-сы ,құраст.:Т.С.Байпақбаев, Т.С.Кенжебекова, А.И.Мамырбаева. - Алматы : АЭжБУ, 2016. - 34б |

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| **Module name** | **MEE -В11 Mathematics 2** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Kaz Assoc. prof. Iskakova Akzholtay Kurmantaevna, prof. Baisalova Manshuk Zhumamuratovna  Rus Assoc. prof. Masanova Aida Zhailauovna, Assoc.prof. Vasilina Gulmira Kazhymuratovna  Eng Assoc.prof. Kim Regina Evgenievna |
| **Language** | Kaz/rus/eng |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory, university component |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15; Practice - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | **Fundamentals of microprocessor technology 1** |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Introduction to the fundamental concepts of the sections: "Differential and integral calculus of a function of several variables", "Ordinary differential equations", "Series" for possible independent study of various special sections of the functions theory.  **LEARNING OUTCOMES:**  **Bachelors know:**  - properties of a function of several variables: (boundedness, existence of the largest and smallest values, complex functions, partial increments and derivatives, total increments and differentials; basic methods of integrating double and triple integrals (change of variables, calculation in polar coordinates);  - types of differential equations and methods for their solution; expansions of functions into power series and Fourier series; basic formulas for calculating the probabilities of random variables.  **are able to:**  - apply methods for solving differential equations in applied problems solution; obtain approximate values of solutions by expanding into power series and Fourier series with a given accuracy; determine the optimal methods for solving practical problems.  **COMPETENCES:**  **-** Ability to apply mathematical modeling methods to solve specific engineering problems.  - Ability to solve methods of differential and integral calculus of a function of several variables in applied problems.  - demonstrate the skills of logical thinking and independent activity. |
| **Content** | The fundamentals of differential and integral calculus of functions of several variables are outlined, ordinary differential equations, series.  The basic properties of partial derivatives, multiple integrals, the main classes of first-order equations, methods for solving differential equations, convergence criteria for series with positive terms, convergence interval, convergence region are studied. |
| **Current control** | Calculation and graphic works - 3, Midterm control 2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software. |
| **References** | 1. Bugrov Ya.S., Nikolski S. M. Higher Fundamentals of microprocessor technology. Volume 3, Differential Equations. Multiple integrals. Moscow, "URAIT" 2020, 289p. <https://urait.ru/viewer/vysshaya-matematika-v-3-t-tom-3-v-2-kn-kniga-1-differencialnye-uravneniya-kratnye-integraly-452424#page/1>  2.Individualnye zadaniya po vysshei matematike: Kompleksnye chisla. Neopredelennye I opredelennye integraly. Funkcii neskolkih peremennyh. Obyknovennye differencialnye uravneniya: Ucheb.posobiye/ pod red. A P. Ryabushko -–Mn.: Vyssh.shk., 2007.- 396 s.  3. Individualnye zadaniya po vysshei matematike: Ryady. Kratnye I krivolineinye integraly. Elementy teorii polya: Ucheb.posobiye/ pod red. A P. Ryabushko -–Mn.: Vyssh.shk., 2004.- 367 s.  4. Ryabushko A. P. Individualnye zadaniya po vysshei matematike: Operacionnoye ischisleniye. Elementy teorii ustoichivosti. Teoriya veroyatnostei. Matematicheskaya statistika.: Ucheb.posobiye - Mn.: Vyssh.shk., 2006.-336 s.  5. Pismenny D.Т. Konspect lekci po vysshei matematike. 1 part. – М.: Rolf, 2007. – 288 s.  6. Nurpeisov S.А., Ultarakova G.А. Matematika 2. Konspekt lekci. For students of all specialties. - Almaty: AUES, - 2013. - 50 p. <http://libr.aues.kz/facultet/frts/kaf_vm/10/umm/vm_6.htm>  7. Masanova А Zh. Matematika 2. Metodicheskiye ukazaniya I zadaniya k vypolneniyu raschetno-graficheskih rabot for students of all specialties. - Almaty:AUES,-2020.-68 p. <http://libr.aues.kz/facultet/104_FIT/137_Kafedra_matematiki_i_matematicheskogo_modelirovaniya/247_Matematika_2/WiHhO6xQ8LU9q5j2VJzAoDnFIbr3lB.pdf> |

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| **Module name** | **MEE -В12 Practical practice. Designing in AutoCAD, Solid Works / Computer Graphics Basics** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Koilybayeva R. K. |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory, university component |
| **Teaching methods** | Practice |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 90 hours  **Class hours:**  Practice -30; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Information and Communication Technologies |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** students gaining knowledge of the basics of computer-aided design systems (CAD), USDD standards and general rules for drawings, skills in performing two-dimensional drawings and sketches in AutoCAD and SolidWorks systems, creating solid models and draughting on their basis.  **LEARNING OUTCOMES:**  **know:**  - general drawings rules  − types of products and types of design documentation  − interface, basic commands and operating modes in AutoCAD and SolidWorks systems  − principles of solid modeling and assembly creation in AutoCAD and SolidWorks systems  **be able**:  − to perform geometric constructions in AutoCAD and SolidWorks systems  − to perform three-dimensional models of parts in AutoCAD and SolidWorks systems  − to perform drawings of parts based on solid models in AutoCAD and SolidWorks systems  **Competences:**  - Demonstrate the skills of applying the acquired knowledge when sketching technical drawings   * - Ability to analyze reference and regulatory literature, draw up technical documentation |
| **Content** | Study the theory fundamentals, rules and general standards requirements for the construction and execution of graphic design documents and the implementation of two-dimensional and three-dimensional models of objects (parts, assembly products, diagrams) in AutoCAD, Solid Works computer programs related to the design, manufacture and operation of various technological machines, mechanisms and appliances. |
| **Current control** | Midterm control, test, projects |
| **Final control** | Test, project works |
| **Study and examination requirements** | Personal computer, Software |
| **References** | 1.Дінасылов А. Д., Яхъяев Э. А., Мажиев Е. М. Конструкторлық құжаттарды орындаудың жалпы ережелері: Оқу құралы. - Алматы: АЭжБУ, 2016.  2. Дінасылов А.Д., Балбаев Ғ.Қ. Компьютерлік сызу және 3D-модельдеу негіздері. AutoCAD жүйесінде графикалық қарапайымдармен жұмыс істеу дағдыларын игеру. ...мамандықтарының барлық оқу түрлерінің студенттері үшін зертханалық жұмысты орындауға арналған әдістемелік нұсқау. - Алматы: АЭжБУ, 2012.  3. А.Д.Дінасылов, Р.Қ.Қойлыбаева. Компьютерлік сызу және 3D-модельдеу негіздері. AutoCAD жүйесінде сызбаларды редакциялау және безендіру командаларымен жұмыс істеу дағдыларын игеру. Барлық мамандықтардың студенттері үшін зертханалық жұмысты орындауға арналған әдістемелік нұсқау. – Алматы: АЭжБУ, 2013. - 39 б.  4. А.Д. Дінасылов, Р.Қ.Қойлыбаева., Е.М.Мажиев. Компьютерлік сызу және 3D модельдеу негіздері. Бұрандамамен біріктіру сызбасын орындау. Барлық оқу түрлерінің студенттері үшін зертханалық жұмысты орындауға арналған әдістемелік нұсқау. – Алматы: АЭжБУ, 2011. –19 б. |

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| **Module name** | **MEE -В13 Information and communication technology**  **(in English)** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Zhumagulova Sholpan Pernebaikyzy |
| **Language** | English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Philosophy, Sociology, Culturology, Psychology cultural studies |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** give an idea of the architecture of computing systems, operating systems and networks, to acquaint with the basic concepts of development of network and web applications, with the basics of information security; explain the principles of information and communication technologies and e-learning;  **LEARNING OUTCOMES:**  **Bachelors know**:  - economic and political factors in the development of information and communication technologies;  - features of various operating systems;  **are able**:  - identify the main trends that students will be able to;  - to process vector and raster images;   * - create multimedia presentations   **COMPETENCES:**  - use information resources to search and store information;  - work with spreadsheets, perform data consolidation, build diagrams;  - work with databases;  - use different social platforms for communication;  - use various forms of e-learning to expand professional knowledge;  - use various cloud services. |
| **Content** | Computer architecture. Basic PC devices, their characteristics. The concept of a computer system (CS). The main CS components. Means of communication. IT software. System products: operating systems, anti-virus programs, diagnostic programs. Work in the operating system: files, folders, shortcuts. Antivirus protection of a computer system. Text editors and word processors. Editing and formatting text documents. Work with tables. Insertion and editing of graphic objects. Integrated text documents. Use of MS WORD possibilities in professional activities. Creation of Excel documents. Tables building. Calculations in tables: formulas, functions. Data presentation in graphical form: construction of diagrams. Organization of links between tables. Use of the MS Excel capabilities for professional activities. Basic concepts: database and database management systems. DBMS MS Access. Basic objects (tables, forms, reports, queries). Use of information presented in specialized databases. Information transfer. Communication lines, their main components, and characteristics. Computer networks: purpose, structure, resources. Local and global computer networks. Basic computer network services: e-mail, teleconferencing, file archives. The main protocols for the information exchange in the network. Programs for creating graphic objects, programs for demonstration graphics. Requirements for creating presentations. Slides creation and design. Animation effects applications to objects. Organization of transitions between slides. The use of hyperlinks. Presentation demonstration. Internet technologies. Cloud and mobile technologies. Multimedia technologies. Smart technologies. Electronic technologies. Electronic business. E-learning. Electronic government. Information technologies in professional sphere. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Zarubin M.Yu., Cryptographic Systems=Криптографические системы : textbook / M.u. Zarubin, G.S. Ybytaeva. - Алматы : Бастау, 2021. - 320 с. - (МОН РК)  2. Alzhanov A.K., Information Communication Technologies : Educational - methodical manual / A.K. Alzhanov, G. Abildinova , D.A. Ramazanova. - Almaty : Эверо, 2021. - 176 p.  3. Information and communication technologies : Textbook / G.T. Jussupbekova, G.A. Besbayev, S.T. Akhmetova и др. - Almaty : Evero, 2021. - 220 p.  4. Гвоздева В.А., Информатика, автоматизированные информационные технологии и системы : учебник / В.А. Гвоздева. - М. : ФОРУМ: ИНФРА-М, 2021. - 542с. - (Высш.образование. Бакалавриат)  5 Брыксина О. Ф., Информационно-коммуникационные технологии в образовании : учебник / О.Ф. Брыксина, Е.А. Пономарева, М.Н. Сонина. - М. : ИНФРА-М, 2021. - 550 с. - (Высшее образование: Бакалавриат)  6. Сыздыкова Н.К., Информационно-коммуникационные технологии : электронное учебное пособие / Н.К. Сыздыкова, К.М. Турдыбекова, Р.Ж. Толеуханова; КарГУ им. Е.А. Букетова. - Қараганда, 2017. - (СD-ROM) |

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| **Module name** | **MEE-В15 Bases of algorithmization and programming** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Adilgazhinova Sairan Adilgazhykyzy |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15;Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics, Информационно-коммуникационные технологии |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to study the main stages of solving problems on computers, the basics of algorithmization, ways of writing algorithms, high-level algorithmic languages, program structure, programming style, data types, dynamic data structures, basic operators of high-level languages, modular programs, program development methods, methods software design, methods for designing, debugging and verifying programs..  **LEARNING OUTCOMES:**  **Bachelors know**:  - main algorithmic languages ​​and their areas of application;  - methods and properties of algorithms, principles of constructing algorithms;  - structures of algorithms and programs, methods of debugging and testing programs;  - basic algorithmization of tasks, data types, basic operators of high-level languages;  - modular programs, elements of structured programming, programming style.  **are able**:  - develop algorithms for solving various problems;  - write programs in algorithmic languages ​​at a high professional level, competently using the language tools;  - debug and test programs using the tools and help desk of the software environment;  - use standard libraries and built-in features of algorithmic languages;.  **COMPETENCES:** use the capabilities of computer systems in the development of programs;  - apply methods and tools for developing algorithms and programs, structural programming techniques, methods for writing an algorithm in a high-level language, debugging and testing methods;  - Compile high-quality program documentation.. |
| **Content** | The basics of algorithmization and programming are outlined. The properties and methods for calculating linear electrical circuits at constant currents and voltages are studied; methodology for calculating electrical circuits of a single-phase sinusoidal current in a complex form; connection diagrams and calculation of symmetrical and asymmetric modes of three-phase circuits with static load. Consolidation of the acquired knowledge takes place in laboratory classes on the universal laboratory stands of UILS. The software products Mathcad, Electronics Workbench are used. The concepts of an integrated programming environment are studied; goals, principles and basic structures of structured programming; |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Введение в программирование на языке Visual C# : учеб. пособие / С.Р. Гуриков. — М. : ФОРУМ : ИНФРА-М, 2019. — 447 с. — (Высшее образование: Бакалавриат). - Режим доступа: http://znanium.com/catalog/product/1017998  2. Трофимов В. В., Павловская Т. А. ; Под ред. Трофимова В.В. - АЛГОРИТМИЗАЦИЯ И ПРОГРАММИРОВАНИЕ. Учебник для вузов - М.:Издательство Юрайт - 2020 - 137с. - ISBN: 978-5-534-07834-3 - Текст электронный // ЭБС ЮРАЙТ - URL: https://urait.ru/book/algoritmizaciya-i-programmirovanie-452333  3. Трофимов, В. В. Основы алгоритмизации и программирования : учебник для СПО / В. В. Трофимов, Т. А. Павловская ; под ред. В. В. Трофимова. — М. : Издательство Юрайт, 2018. — 137 с. — (Серия : Профессио нальное образование).  4.Гуриков С.Р., Основы алгоритмизации и программирования в среде LAZARUS : учеб. пособие / С.Р. Гуриков. - М. : ИНФРА-М, 2021. - 336 с. - (Высшее образование: Бакалавриат)  5 <http://libr.aues.kz/facultet/fit/is/20/umm/kniga.pdf>).  <http://rmebrk.kz/bilim/association/boribaev_programmalau.pdf>). |

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| **Module name** | **MEE -В16 Theoretical basis of electrical engineering 1** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Associate Professor Baimaganov Aliaskar Sainovich (Russian, English)  Senior Lecturer Dagarbek Rakhatbek (Kazakh language) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 4 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** study of steady-state processes in linear electrical circuits of direct and single-phase sinusoidal currents, as well as in three-phase circuits..  **LEARNING OUTCOMES:**  **Bachelors know**:  - basic laws in electric circuits of direct current;  - basic laws in electric circuits of sinusoidal current;  - used schemes and methods for calculating the modes of three-phase circuits;  **are able**:  - apply the knowledge gained in the study of the TOE1 course to solve applied problems;  - apply methods for calculating the circuits of direct and sinusoidal currents;  - explore different modes in three-phase electrical circuits..   * **COMPETENCES:**   - to make calculation of the established modes in electric power installations;  - analyze reference and normative literature, draw up technical documentation;  - carry out adjustment and testing of electrical installations. |
| **Content** | The properties and methods for calculating linear electrical circuits at constant currents and voltages are studied; methodology for calculating electrical circuits of a single-phase sinusoidal current in a complex form; connection diagrams and calculation of symmetrical and asymmetric modes of three-phase circuits with static load. Consolidation of the acquired knowledge takes place in laboratory classes on the universal laboratory stands of UILS. The software products Mathcad, Electronics Workbench are used. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. М. М. Аршидинов, Л. П. Болдырева. Теоретические основы электротехники Методические указания и задания к выполнению расчетно-графических работ №1–3 (для специальности 5В071800 – Электроэнергетика). Алматы: АУЭС, 2016. – 18 с. 2. Л. П. Болдырева, Г. К. Смагулова. Теоретические основы электротехники 1. Методические указания и задания по выполнению лабораторных работ для студентов специальности 5В071800 – Электроэнергетика. Алматы: АУЭС, 2016. – 35 с. 3. Аршидинов М. М., Денисенко В. И., Болдырева Л. П. Теоретические основы электротехники: Учебное пособие, АУЭС, Алматы, 2016. – 98 с. 4. Бессонов Л. А. Теоретические основы электротехники. Электрические цепи – М.: Издательство Юрайт, 2016. – 701 с. 5. Атабеков Г. И. ТОЭ. Линейные электрические цепи. – СПб.: «Лань», 2009. – 592 с. 6. В. И. Денисенко, С. Ю. Креслина. Теоретические основы электротехники 1. Конспект лекции (для студентов всех форм обучения специальности 050718 – Электроэнергетика). Алматы: АИЭС, 2006. – 63 с. 7. В. И. Денисенко, С. Ю. Креслина. Теоретические основы электротехники 2. Конспект лекции (для студентов всех форм обучения специальности 050718 – Электроэнергетика). Алматы: АИЭС, 2007. – 62 с. |

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| **Module name** | **MEE -В17-1 Safety rules in electrical installation** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Senior teacher Bekmuratova Nurzhamal Sarsenbaevna (kaz)  Senior teacher Tyshchenko Elena Mikhailovna (rus)  Senior lecturer Amangaliyev Yerlan Zingaleevich (eng) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electrical safety" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Introduction to the specialty,  Physics 1  Mathematics |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  study of labor safety issues in the operation of electrical installations up to and above 1 kV, prevention of electrical injuries in industrial enterprises, as well as special issues, knowledge of which is necessary when operating electrical installations in power supply systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  -basic information about the legislation on electrical safety;  -causes of electrical injuries in industrial enterprises;  -basic protective measures and means in electrical installations  industrial enterprises;  - basics of organization of safe operation of electrical installations;  -basic requirements for electrical personnel and first aid measures in case of electrical injury;  **are able**: - analyze the risk of electric shock in various electrical networks;  - select and apply specific technical solutions to ensure  electrical safety.  **COMPETENCES**: - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - provide first aid in case of electric shock. |
| **Content** | The discipline aims to study the protection against electromagnetic fields, the effect of electric current on a person, the resistance of the human body to electric current, the schemes of a person touching the mains, the touch voltage and step voltage, the classification of electrical installations, technical protective measures against electric shock, protective equipment used in electrical installations, requirements for electrical personnel, operational maintenance and inspection of electrical installations, the procedure and conditions for the production of work in electrical installations, organizational measures, technical measures, first aid to victims of electric current. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1.Менумеров, Р. М. Электробезопасность : учеб. пособие / Р.М. Менумеров. - 4-е изд., стер. - СПб : Лань, 2020. - 196 с  2. Сибикин, Ю.Д Охрана труда и электробезопасность.,.М.: РадиоСофт, 2014 г.  3.Аипов А.К Охрана труда и безопасность жизнедеятельности.,Астана.: «КазУЭФМТ», 2013г;  4 Беляков Г.И. Безопасность жизнедеятельности. Охрана труда., М.:"Юрайт"2012 г.  5 Аманжолов Ж.Охрана труда в энергосистемах. А.:«Фолиант» ,2010г.  6. Электробезопасность. Теория и практика: учебное пособие для вузов /П.А.Долин, В.Т.Медведев.-3 издание, перераб. и доп.-М. Издательский дом МЭИ- 2012 год  7. http://www.electrolibrary  8. http://electricalschool.info |

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| **Module name** | **MEE -В17-2 Electrical safety** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Senior teacher Bekmuratova Nurzhamal Sarsenbaevna (kaz)  Senior teacher Tyshchenko Elena Mikhailovna (rus)  Senior lecturer Amangaliyev Yerlan Zingaleevich (eng) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Safety rules in electrical installation" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Introduction to the specialty,  Physics 1  Mathematics |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  study of the causes of electric shock to a person, methods and means of protecting personnel from the harmful and dangerous effects of electric current, electric arc and atmospheric electricity, organizing work on electrical safety conditions.  **LEARNING OUTCOMES:**  **Bachelors know**:  - possible sources of electric shock;  - the most important technical requirements that ensure the safety of work during the maintenance of power equipment;  - organizational measures to ensure the safety of work in the power plant;  **are able**:  - analyze the danger of electrical networks;  -perform access to work in the power plant with voltage up to 1000 V;  - use personal protective equipment against electric shock and check their serviceability.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - provide first aid in case of electric shock. |
| **Content** | The discipline aims to study the danger of electric current, the analysis of cases of including a person in the current circuit, burns and measures to prevent them, the basic principles and methods of electrical safety, protective grounding. protective zeroing, protective shutdown, protection measures against the transfer of current from a higher voltage network to a lower voltage network. protective equipment classification of premises according to the degree of danger of electric shock, electrical safety requirements for electrical equipment, organizational measures to prevent electrical injuries, first aid to victims of electric shock. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1.Менумеров, Р. М. Электробезопасность : учеб. пособие / Р.М. Менумеров. - 4-е изд., стер. - СПб : Лань, 2020. - 196 с  2. Сибикин, Ю.Д Охрана труда и электробезопасность.,.М.: РадиоСофт, 2014 г.  3.Аипов А.К Охрана труда и безопасность жизнедеятельности.,Астана.: «КазУЭФМТ», 2013г;  4 Беляков Г.И. Безопасность жизнедеятельности. Охрана труда., М.:"Юрайт"2012 г.  5 Аманжолов Ж.Охрана труда в энергосистемах. А.:«Фолиант» ,2010г.  6. Электробезопасность. Теория и практика: учебное пособие для вузов /П.А.Долин, В.Т.Медведев.-3 издание, перераб. и доп.-М. Издательский дом МЭИ- 2012 год  7. http://www.electrolibrary  8. http://electricalschool.info |

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| **Module name** | **MEE -В19 Physics 2** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | PhD Nysanbayeva S. K. (Kazakh)  Associate Professor Associate Professor Salamatina A. M. (Russian, English) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** development of natural-science outlook;  - formation of a fundamental base for the study of general technical and special disciplines of the educational program;  - the formation of students' skills and abilities in the use of fundamental physical laws and theories, as well as the application of physical research methods to solve theoretical and experimental-practical educational problems from various fields of physics.  **LEARNING OUTCOMES:**  **Bachelors know**:  basic theories of classical physics, principles, laws and limits of their applicability;  **are able**:apply theoretical knowledge to solve specific physical problems and situations; evaluate errors and analyze the results of a physical experiment, mathematically model physical situations;.   * **COMPETENCES:** organizing and conducting a simple physical experiment; work with modern measuring devices; |
| **Content** | Electrodynamics, oscillations and waves, the foundations of quantum mechanics, the structure of the atom, the formation of skills for independent cognitive activity, conducting experimental scientific research on physical phenomena that help in the future to solve specific problems in professional activities, modeling physical situations using a computer, working with measuring instruments |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Physics 1. Дәрістер жинағы. 6В07101 – Электр энергетикасы мамандыќтарының студенттеріне арналған. Алматы, АУЭС, 2020.  2. Алджамбекова Г.Т., Наурызбаева Г.К. Physics 1\_«6В07101 –Электроэнергетика» мамандығының студенттеріне арналған ЕСЖ орындау бойынша әдістемелік нұсқаулар. АЭжБУ, 2020.  3. Волькенштейн В.С. Жалпы Physics курсының есептер жинағы. -А., 2012. -485 б  4 Павлов С. В., Общая Physics : сборник задач: учеб. пособие / С.  В. Павлов, Л.А. Скипетрова; под ред. С. В. Павлова. - М. : ИНФРА-М, 2021: ИНФРА-М, 2021. - 319 с. - (Высшее образование: Бакалавриат)9.  5. Электростатика.Тұрақты ток [Мәтін] : зертханалық жұмыст.орынд.арн-н әдіст.нұсқаулар / КЕАҚ АЭжБИ, Physics каф-сы ,құраст.:Т.С.Байпақбаев, Т.С.Кенжебекова, А.И.Мамырбаева. - Алматы : АЭжБУ, 2016. - 34б |

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| **Module name** | **MEE -В20-1 Theory of automatic control** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor Tsyba Yuri Alexandrovich (Russian)  Senior Lecturer Zhanar Zhumakanovna Toygozhinova (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Automatic control systems" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 120 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 84 (SSTS -6)  **Examination preparation hours**: 6 |
| **Credits** | 4 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  study the basic laws of the theory of automatic control, study the methods of analysis and synthesis of automatic control systems in the time and frequency domains, methods for analyzing the stability of linear systems, assessing the quality of control, methods for analyzing nonlinear automatic control systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - terminology, basic definitions of the theory of automatic control;  - basic principles of construction; principles of construction of automatic control systems;  - the main difference between the principle of regulation and the principle of management;  - the main types of typical links and represent their physical essence;  - the main frequency characteristics of the links and methods for constructing phase portraits or hodographs on the phase plane;  - basic principles of static and astatic regulation and their difference;  - the main characteristics of typical dynamic links.  **are able**:  - apply mathematical description and methods of analysis and synthesis of control systems for practical purposes;  - draw up block diagrams and transfer functions of system elements;  - to determine the parameters of the elements by calculation and experiment;  - to compare experimental data with theoretical provisions;  - analyze and describe stationary processes in automatic control systems;  - evaluate the stability and quality of the control process of linear automatic control systems.  **COMPETENCES**:  - draw up block diagrams and transfer functions of system elements;  - to determine the parameters of automation elements by calculation and experiment;  - to compare experimental data with theoretical provisions;  - analyze and describe stationary processes in automation systems;  - evaluate the stability and quality of the control process of linear automation systems;  - to determine the stability of automation by phase portraits;  - in the system of the MATLAB Simulink programmable complex, to conduct research on automation in agriculture. |
| **Content** | Questions of calculation of free and forced movements of coordinates of linear dynamic systems of automatic control are stated. Algebraic and frequency methods are given, as well as the root locus method for studying the stability of systems; methods of quality analysis and synthesis of corrective devices of systems; nomograms of analysis and synthesis of linear systems. The study of systems is carried out in the programmable complex MATLAB Simulink. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Цыба Ю.А. «Теория автоматического управления». Конспект лекций, Алматы: АУЭС, 2018 – 72 с.  2. Кудинов Ю. И., Теория автоматического управления ( с использованием Matlab - Simulink). Практикум : учеб. пособие / Ю.И. Кудинов, Ф.Ф. Пащенко, А.Ю. Келина. - СПб. : Лань, 2020. - 280 с.  3. Малафеев, С.И. Теория автоматического управления: учебник / С.И. Малафеев, А.А. Малафеева. - 2-е изд.,перераб.и доп. - М. : Академия, 2014. - 384с. - (Высш.образование.Бакалавриат).  4. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения [Текст] : учеб.пособие / Л.Д. Певзнер. - СПб. : Лань, 2016. - 604с: ил. - (Учебники для вузов.Специальная литература).  5. Цыба Ю.А., Тойгожинова Ж.Ж., Чныбаева Д.М. Теория автоматического управления. Методические указания к выполнению лабораторных работ для студентов специальности «Электроэнергетика». Алматы: АУЭС, 2018 - 44 с. |

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| **Module name** | **MEE -В20-2 Automatic control systems** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor Tsyba Yuri Alexandrovich (Russian)  Senior Lecturer Zhanar Zhumakanovna Toygozhinova (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Theory of automatic control " |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 120 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 84 (SSTS -6)  **Examination preparation hours**: 6 |
| **Credits** | 4 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering methods for constructing automatic control systems and methods for their mathematical description,  mastering the processes of the principle of stability of automation and methods for its correction.  **LEARNING OUTCOMES:**  **Bachelors know**: - basic principles of construction of automatic controllers of ACS;  - principles of constructing block diagrams of ACS and methods of their transformation; - methodology for compiling ACS operator equations;  - methods for constructing the frequency characteristics of ACS;  - methods for determining the stability of ACS in accordance with the main criteria; - methods for determining quality indicators by the management process in the ACS;  - methods for the synthesis of linear ACS with serial and parallel inclusion of corrective devices;  - principles of building digital and self-adjusting ACS.  **are able**: - compose and convert block diagrams of closed ACS;  - to calculate the main characteristics of the ACS and its elements;  - carry out calculations to determine the stability of linear ACS; - explore the parameters of the ACS in the MATLAB environment;  - determine the parameters of corrective devices;  - build the desired logarithmic frequency characteristics of the ACS; - to simulate ACS in the MATLAB environment;  - analyze transient processes in ACS.  **COMPETENCES**:  - the ability to apply modern software for the construction and study of transient processes;  - virtual simulation of processes in the MATLAB environment in different modes of their operation and in the presence of disturbing influences;  - construction of digital systems with impulse, program and adaptive control. |
| **Content** | The subject of study is the principles of constructing automatic control systems and analysis of control methods. The characteristics and transfer functions of the main elements of modern automatic controllers, including pulse, digital and adaptive, are given. Algebraic and frequency stability criteria and systems synthesis methods are considered to improve the quality of control processes. The study of systems is carried out in the programmable complex MATLAB Simulink. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Цыба Ю.А. «Системы автоматического управления». Конспект лекций, Алматы: АУЭС, 2014 - 70с.  2. Кудинов Ю. И., Теория автоматического управления ( с использованием Matlab - Simulink). Практикум : учеб. пособие / Ю.И. Кудинов, Ф.Ф. Пащенко, А.Ю. Келина. - СПб. : Лань, 2020. - 280 с.  3. Малафеев, С.И. Теория автоматического управления: учебник / С.И. Малафеев, А.А. Малафеева. - 2-е изд.,перераб.и доп. - М. : Академия, 2014. - 384с. - (Высш.образование.Бакалавриат).  4. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения [Текст] : учеб.пособие / Л.Д. Певзнер. - СПб. : Лань, 2016. - 604с: ил. - (Учебники для вузов.Специальная литература).  5. Цыба Ю.А., Тойгожинова Ж.Ж., Чныбаева Д.М. Системы автоматического управления. Методические указания к выполнению лабораторных работ для студентов специальности «Электроэнергетика». Алматы: АУЭС, 2018 - 39 с.  6. Системы автоматического управления: Метод.указ. для вып. расч.-граф. раб. для студ.спец.5В071800 / НАО АУЭС, Каф.электропривода и автоматизации промышленных установок, сост.: Ю.А. Цыба, Д.М. Чныбаева. - Алматы : АУЭС, 2016. |

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| **Module name** | **MEE -В21-1 Use of renewable energy sources** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Senior lecturer Agimov Talgat Nurlanovich (Kazakh)  Associate professor Kazanina Irina Vladimirovna (Russian)  Senior lecturer Soltanayev Abylaikhan Mukhituly (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Alternative energy and energy saving technologies" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2; Electrical machines. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  The discipline aims to study renewable energy sources, their use in the overall energy balance of the country, the principles of energy conversion in renewable energy technologies.  A variety of types of renewable energy sources, their potential at the present time and in the future, the operating conditions of the main elements of such power plants during operation, the structure of organizations for managing the operation of power plant systems based on RES, the impact of RES technologies on the environment and ecology are being studied.  **LEARNING OUTCOMES:**  **Bachelors know**:  - methods, mechanisms, equipment and systems for the conversion of RES;  - on the rational use of the energy received in agriculture;  - device, principle of operation, main technical capabilities, areas of application of the possibility of rational use of power plants based on renewable energy sources;  - principles of automation of RES processes and equipment;  **are able**:  - to formulate practical tasks for the application of RES methods and technologies in production;  - make practical calculations and selection of power plants based on renewable energy sources;  - develop organizational and technical measures for the operation of RES installations.  **COMPETENCES**:  -work with the methodology for calculating the main technical and economic indicators of the organization (enterprise);  -determine the ways and methods of planning and organizing labor and work in production;  -develop prospects for the technical development of the energy sector. |
| **Content** | The discipline is devoted to the description and analysis of renewable energy sources, their use in the overall energy balance of the country and regions. The discipline also covers the issues of all-round energy saving in industry, agriculture and housing and communal services. The issues of using secondary energy resources are also considered. and improving environmental conditions; technical and economic indicators of the use of renewable energy sources in agriculture; application of resource-saving technologies using renewable energy sources. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1.Сивков А. А., Основы электроснабжения : учеб. пособие / А.А. Сивков, А.С. Сайгаш, Д.Ю. Герасимов; Томский политехнический ин-т. - 2-е изд., испр. и доп. - М. : Юрайт, 2020. - 174 с. - (Высшее образование; НИТПУ)  2. Юдаев И. В., Возобновляемые источники энергии : учебник / И.В. Юдаев, Ю.В. Даус, В.В. Гамага. - 2-е изд., стер. - СПб. : Лань, 2021. - 328 с.  3. Мукажанов В. Н. Возобновляемые источники энергии. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  4. Казанина И.В. Энергосбережение. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  6. https://www.popmech.ru/technologies/176861-10-luchshikh-alternativnykh-istochnikov-energii/ |

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| **Module name** | **MEE -В21-2 Alternative energy and energy saving technologies** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Senior lecturer Agimov Talgat Nurlanovich (Kazakh)  Associate professor Kazanina Irina Vladimirovna (Russian)  Senior lecturer Soltanayev Abylaikhan Mukhituly (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Use of renewable energy sources" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2; Electrical machines. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  The study of modern and promising areas of alternative energy, solar energy, the wind energy potential of the country, nuclear energy, the use of water resources in the energy sector, the possibilities of bioenergy, energy of motion.  The discipline aims to study the issues of energy saving in industry, agriculture and housing and communal services, the use of secondary energy resources, the impact of alternative energy on the country's environmental conditions; technical and economic indicators of the use of renewable energy.  **LEARNING OUTCOMES:**  **Bachelors know**:  - principles of functioning and construction of renewable energy installations (solar, wind, hydropower, etc.);  - environmental aspects of the use of alternative energy sources;  - main parameters of renewable energy installations;  - the role of alternative and renewable energy sources in the formation of energy in Kazakhstan and the world;  - features of the use of renewable energy sources;  **are able**:  - evaluate the risk and environmental consequences of using alternative energy sources;  - conduct a comparative analysis of the principles of converting alternative energy sources into the required type of energy;  - substantiate the application of the principles of converting alternative energy sources and determine the composition of electric power and electrical equipment in non-traditional energy facilities.  **COMPETENCES**:  - has the skills to assess the risk and environmental consequences of the use of alternative energy sources;  - skills in assessing the main production resources of renewable energy facilities;  - skills in calculating the parameters of renewable energy installations. |
| **Content** | The discipline is devoted to the description and analysis of alternative energy sources, their use in the overall energy balance of the country and regions. The discipline also covers the issues of all-round energy saving in industry, agriculture and housing and communal services. The discipline includes alternative and renewable energy sources, environmental aspects of use, ways to convert alternative energy sources into mechanical, thermal and electrical energy, non-traditional power plants. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1.Сивков А. А., Основы электроснабжения : учеб. пособие / А.А. Сивков, А.С. Сайгаш, Д.Ю. Герасимов; Томский политехнический ин-т. - 2-е изд., испр. и доп. - М. : Юрайт, 2020. - 174 с. - (Высшее образование; НИТПУ)  2. Юдаев И. В., Возобновляемые источники энергии : учебник / И.В. Юдаев, Ю.В. Даус, В.В. Гамага. - 2-е изд., стер. - СПб. : Лань, 2021. - 328 с.  3. Мукажанов В. Н. Возобновляемые источники энергии. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  4. Казанина И.В. Энергосбережение. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  6. https://www.popmech.ru/technologies/176861-10-luchshikh-alternativnykh-istochnikov-energii/ |

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| **Module name** | **MEE -В22-1 Electrotechnical materials and products** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | PhD Amitov Ernar Tanirbergenuly |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electrotechnical materials science" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge among bachelors about the classification and physical properties of electrical materials, their scope in the construction of electrical equipment, as well as production technology.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the physical nature of electrical materials;  - the main problems in the production of electrical materials and products;  - types, classification and purpose of electrical insulating, conductive, semiconductor materials used in electrical engineering.  **are able**:  - evaluate the behavior of materials when exposed to various operational facts;  - calculate the dielectric properties of insulating materials;  - use laboratory instruments to measure and process the results of the experiment.  **COMPETENCES**:  - able to evaluate the insulating properties of electrical materials;  - calculate the service life of electrical materials in electrical machines and electrical networks;  - substantiate the technical and economic feasibility of using electrical materials and products in various electrical equipment. |
| **Content** | The study of physical phenomena in electrical materials when they are in an electromagnetic field. Analysis and assessment of the state and properties of electrical materials of electrical machines and switching devices when exposed to various operational factors. Scope of electrical materials in the electric power industry. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Серебряков А.С. Электротехническое материаловедение. Электроизоляционные материалы. – М.: Маршрут, 2005. – 280 с.  2. Суюндукова Б.К., Тугерова Г.Б, Арапова Г.Б., Келазев А.В. Электротехнические материалы Учебное пособие. — Астана: НАО Холдинг Кəсіпқор, 2018. — 150 с.  3. Алиев И.И. Электротехнические материалы и изделия: Справочник. – М.: Academia, 2005 – 270 с.  4. Бекмагамбетова К.Х. Электротехническое материаловедение. –Алматы: «Ғылым», 2001.-256 с  5. Привалов Е.Е. Электротехническое материаловедение Учебное пособие. — Москва; Берлин: Директ-Медиа, 2015. — 234 с.  6. Клюжев Ю., Материаловедение с основами электроматериаловедения: учебник / Ю. Клюжев, В. Скворцов, М. Кайырбаев; под ред. Г. Г. Бондаренко. - 2-е изд., перераб. и доп. - Астана: Фолиант, 2017. - 224 с.  7. Амиров Ж.Х., Бекмагамбетова К.Х. Electrotechnical materials science. Алматы, АИЭС. 2009.  8. Бондаренко Г. Г., Материаловедение: учебник для СПО / Г.Г. Бондаренко, Т.А. Кабанова, В.В. Рыбалко; под ред. Г. Г. Бондаренко. - М: Юрайт, 2019. - 328 с. - (Профессиональное образование)  9. Кузембаева Р.М., Мукашева Р.Т. Электротехническое материалы и изделя. Конспект лекций. (Для студентов всех форм обучения специальности 5В071800 – Электроэнергетика.) рус/каз- для спец. ЭСХ. Алматы: АУЭС, 2015. 10.http://window.edu.ru/catalog/pdf2txt/105/45105/21883  11. http://sermir.narod.ru/lec/lect1.htm |

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| **Module name** | **MEE -В22-2 Electrotechnical materials science** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | PhD Amitov Ernar Tanirbergenuly |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electrotechnical materials and products" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge among bachelors about the physical phenomena occurring in materials when they are introduced into an electromagnetic field, as well as the properties of various electrical materials of the main electrical equipment of electrical networks.  **LEARNING OUTCOMES:**  **Bachelors know**: -  fundamentals of electrical materials science;  - behavior of dielectrics in electrostatic fields;  - the physical essence of the phenomena occurring in electrical materials under operating conditions;  - basic properties of modern electrical materials;  - classification of materials according to the condition of conductivity.  - fundamentals of materials science, the behavior of materials in electrostatic fields.  **are able**:  - to determine the properties of dielectrics when they are placed in an electrostatic field;  - evaluate the insulating properties of electrical materials;  - to determine dielectric losses in insulating materials.  **COMPETENCES**:  - the ability to use technical means to determine the parameters of electrical materials;  - own methods of analyzing the quality of electrical materials;  - substantiate the scope of electrical materials.. |
| **Content** | Obtaining fundamental knowledge about the physical processes in electrical materials in the conditions of production and operation. The study of the main characteristics, properties and areas of application of modern electrical materials. Laboratory studies of the dielectric properties of common electrical materials. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Серебряков А.С. Электротехническое материаловедение. Электроизоляционные материалы. – М.: Маршрут, 2005. – 280 с.  2. Суюндукова Б.К., Тугерова Г.Б, Арапова Г.Б., Келазев А.В. Электротехнические материалы Учебное пособие. — Астана: НАО Холдинг Кəсіпқор, 2018. — 150 с.  3. Алиев И.И. Электротехнические материалы и изделия: Справочник. – М.: Academia, 2005 – 270 с.  4. Бекмагамбетова К.Х. Электротехническое материаловедение. –Алматы: «Ғылым», 2001.-256 с  5. Привалов Е.Е. Электротехническое материаловедение Учебное пособие. — Москва; Берлин: Директ-Медиа, 2015. — 234 с.  6. Клюжев Ю., Материаловедение с основами электроматериаловедения: учебник / Ю. Клюжев, В. Скворцов, М. Кайырбаев; под ред. Г. Г. Бондаренко. - 2-е изд., перераб. и доп. - Астана: Фолиант, 2017. - 224 с.  7. Амиров Ж.Х., Бекмагамбетова К.Х. Электротехническое материаловедение. Алматы, АИЭС. 2009.  8. Бондаренко Г. Г., Материаловедение: учебник для СПО / Г.Г. Бондаренко, Т.А. Кабанова, В.В. Рыбалко; под ред. Г. Г. Бондаренко. - М: Юрайт, 2019. - 328 с. - (Профессиональное образование)  9. Кузембаева Р.М., Мукашева Р.Т. Электротехническое материалы и изделя. Конспект лекций. (Для студентов всех форм обучения специальности 5В071800 – Электроэнергетика.) рус/каз- для спец. ЭСХ. Алматы: АУЭС, 2015. 10.http://window.edu.ru/catalog/pdf2txt/105/45105/21883  11. http://sermir.narod.ru/lec/lect1.htm |

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| **Module name** | **MEE-В24 Module of socio-political knowledge (political science, sociology)** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Associate Professor Mukhambedyarova Altynai Tuleuovna (Russian)  Cand.Pedag.Sc, Senior Lecturer Bisenova Aliya Zakirzhanovna (Kazakh)  Cand.His.Sc, Associate Professor Baidildina Saule Khairulovna (English) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, semester works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-30; Practical classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Philosophy, Modern history of Kazakhstan |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to give students scientifically based objective knowledge of sociology, as well as to promote the formation of the ability to understand the social mechanisms of the functioning of society, conduct social research and interpret their results, consider problems that contribute to scientific knowledge of the surrounding, social world, understanding that a person is connected with social reality.  **LEARNING OUTCOMES:**  **Bachelors know**:  -explain the nature of situations in various areas of social communication based on the content of the theories and ideas of the scientific fields of the studied disciplines;  - analyze the features of social, political, cultural, psychological institutions in the context of their role in the modernization of Kazakhstani society;  -develop programs for resolving conflict situations in society, including professional society;  -correctly express and reasonably defend their own opinion on issues of social significance.  **are able**:to develop cognitive and practical abilities.  **COMPETENCES:**  - independently analyze the processes and phenomena occurring in society;  - correctly and reasonably formulate your thoughts orally and in writing;. |
| **Content** | The study of social and political institutions, movements, value orientations that regulate the behavior of the individual is outlined.  The rationalistic, reasonable nature of sociology and political science invariably opposes the irrationalistic tendencies present in any society, social chaos and anomie.  The common sense and sense of realism of sociology and political science are studied in the process of modernization of society. |
| **Current control** | Semestr works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC |
| **References** | 1.Биекенов К.У., Биекенова С.К., Кенжакимова Г.А. "Социология: Уч.пособие". – Алматы: Эверо,2016. – 584с.  2.Əбдірайымова Г.С. "Жастарсоциологиясы": оқуқұралы. 2- басылым. – Алматы:"Қазақуниверситеті", 2012. – 224с.  3.Грушин Б.А. "Мнения о мире и мир мнений". М.: Праксис, ВЦИОМ, 2011.  4."Социология. Основы общей теории: учебник" / Под ред. Г.В. Осипов, Л.Н. Москвичев.  - 2-е изд., испр. и доп. - М.: Норма, 2015. - 912 с.  6.Дж. Ритцер, Дж. Степницки. "Əлеуметтанутеориясы". – Алматы: "Ұлттықаудармабюросы" қоғамдыққоры, 2018. – 856 с.  7. Послание Главы государства Касым-Жомарта Токаева народу Казахстана ЕДИНСТВО НАРОДА И СИСТЕМНЫЕ РЕФОРМЫ – ПРОЧНАЯ ОСНОВА ПРОЦВЕТАНИЯ СТРАНЫ // https://www.akorda.kz/ru/poslanie-glavy-gosudarstva- kasym-zhomarta-tokaeva-narodu-kazahstana-183048  8. Чеботарёв А.Е. Политическая мысль суверенного Казахстана: динамика, идеи,оценки. Алматы: ИМЭП при Фонде Первого Президента, 2015.  9.Гринин Л. Е. Государство и исторический процесс. Политический срез историческогопроцесса.- М.: Либроком, 2014.  10.Булуктаев Ю.О. Политический режим и посткоммунистическая трансформация:теория, методология, практика.- Алматы, 2008. |

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| **Module name** | **MEE-В25 Module of socio-political knowledge (culturology, psychology)** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | senior lecturer Abdieva G.I (Russian)  PhD Ashirbaeva N.N. (kaz. / rus) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Philosophy, Modern history of Kazakhstan |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to teach students to navigate in the diversity of cultures, understanding their own and other cultures. Formation in future specialists of the foundations of cultural and psychological knowledge in the field of development of personal and professional competencies of a future specialist. Formation of its individual typological features, professional self-determination, ensuring the use of a harmonious and successful personality in the process of professional formation and development.  **LEARNING OUTCOMES:**  **Bachelors know**:  - classical and modern theories of the development of society and the role of culture in society;  - new trends and directions, programs for the development of the culture of their people and country;  - the main theoretical concepts of the development of individual typological features of the personality in the process of professional activity;  - the content and specifics of professional communication, interpersonal communication and psychological impact within the chosen specialty.  **are able**:- independently analyze the processes and phenomena occurring in society;  - to analyze culture as a system of cultural phenomena, identifying the types of links between elements of culture;  - effectively apply psychological methods, techniques and techniques of motivation and communication in personal and professional activities;  - skillfully use psychodiagnostic techniques to study the individual psychological characteristics of specialists in a team.  **COMPETENCES:** - apply knowledge of the theoretical foundations of cultural studies and psychology in professional activities;  - to use new trends and directions of culture in the development of individual psychological characteristics of the individual for the successful implementation of the professional activities of a specialist;  - apply psychological mechanisms for building effective professional communication and harmonious interaction with people in a team. |
| **Content** | The socio-political knowledge module (Cultural Studies and Psychology) is to form the social and humanitarian worldview of students in the context of solving the problems of modernizing public consciousness. Theoretical knowledge in this module is used in the professional activities of the individual, to orient students to knowledge about the cultural achievements of mankind, understanding and mastering the basic laws and basic forms of development and formation of the culture of the individual. This module will allow you to gain psychological knowledge in the field of personality development of a future specialist, the formation of its individual typological features, features of professional self-determination, as well as gain the ability to manage technologies for effective interpersonal communication and psychological impact as a factor in the development of a harmonious and successful personality of a future specialist. |
| **Current control** | Semester works-2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC |
| **References** | 1. Бейсенова Г.А. «Проблемы глобализации и идентичности» – А., Print, 2009. 2. Ғабитов Т.Х. «Қазақ мәдениетінің тарихы: оқу құралы». – Алматы: Қазақ университеті, 2016. 3. Жолдубаева А.К. «Культурология: практикум». - Алматы: Казну им.аль-Фараби, 2014. 4. Абдиева Г.И. Психолого-педагогические особенности социализации личности в юношеском возрасте. Алматы «Қазақ университеті» 2020 5. Абдиева Г.И. Учебное пособие «Психология и педагогика». Алматы «Қазақ университеті» 2021 6. Джакупов С.М. «Введение в общую психологию». – А.: Қазақ университеті, 2014. 7. Руденко А.М. «Психология в схемах и таблицах»: учебное пособие. – М: Феникс, 2016. – 379 с. 8. Құнанбаева М.Н. Основы психологиической сaморегуляции: учебное пособие. А.: Қазақ университеті, 2017. |

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| **Module name** | **MEE-В26 Theoretical basis of electrical engineering 2** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Associate Professor Baimaganov Aliaskar Sainovich (Russian, English)  Senior Lecturer Dagarbek Rakhatbek (Kazakh language) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 4 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** study of transient processes in linear electrical circuits, the theory of quadripoles and electrical filters, circuits with distributed parameters.  **LEARNING OUTCOMES:**  **Bachelors know**:  - basic laws that allow analyzing, both qualitatively and quantitatively, transient processes in linear electrical circuits;  - theory of quadripoles and frequency electric filters;  - methods for calculating steady-state modes in linear electrical circuits with distributed parameters;  **are able**:  - calculate transient processes in linear circuits with one energy storage device;  - calculate transient processes in linear circuits with two energy storage devices;  - to determine the parameters of quadripoles in various operating modes and to select the parameters of frequency filters;  - analyze the transfer of energy along long lines.   * **COMPETENCES:**   - to calculate non-stationary modes in electric power plants;  - analyze reference and normative literature, draw up technical documentation;  - calculate and analyze transfer functions and various modes in homogeneous power lines;  - set up and test electrical power devices. |
| **Content** | Methods of analysis and calculation of transient processes in linear electrical circuits using classical and operator methods; basic relations of the theory of symmetrical passive quadripoles; characteristics describing ideal frequency electrical filters; theory of circuits with distributed parameters. Consolidation of the acquired knowledge takes place in laboratory classes on the universal laboratory stands of UILS. The software products Mathcad, Electronics Workbench are used. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Денисенко В. И., Болдырева Л. П., Смагулова Г. К, Нурмадиева Э. А. ТОЭ2. Методические указания и задания к лабораторным работам по образовательной программе 6В07101 – «Электроэнергетика» – Алматы: АУЭС, 2021. – 42 с. 2. Денисенко В. И., Аршидинов М. М. ТОЭ2. Методические указания и задания к расчетно-графическим работам №1–3 для студентов специальности 5В071800 – Электроэнергетика. Алматы: АУЭС, 2018. – 14 с. 3. Аршидинов М. М., Денисенко В. И., Болдырева Л. П. Теоретические основы электротехники: Учебное пособие, АУЭС, Алматы, 2016. – 98 с. 4. Бессонов Л. А. Теоретические основы электротехники. Электрические цепи – М.: Издательство Юрайт, 2016. – 701 с. 5. Прянишников В. А. ТОЭ: Курс лекций: Учебное пособие – 3-е изд., перераб. и доп. – СПб., 2012 – 368 с. 6. Атабеков Г. И. ТОЭ. Линейные электрические цепи. – СПб.: «Лань», 2009. – 592 с. 7. В. И. Денисенко, С. Ю. Креслина. Теоретические основы электротехники 2. Конспект лекции для студентов всех форм обучения специальности 050718 – Электроэнергетика. Алматы: АИЭС, 2007. – 62 с. 8. В. И. Денисенко, Г. М. Светашев. Теоретические основы электротехники 3. Конспект лекций для студентов всех форм обучения специальности 050718 – Электроэнергетика. Алматы: АИЭС, 2007. – 90 с. |

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| **Module name** | **MEE - В27-1 Heat engineering and basis of heat power engineering** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Kibarin Andrey Anatolievich |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Fundamentals of heat supply" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-30; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to form students' minimum knowledge about the processes of heat transfer and heat and mass transfer in heat and power plants, types and methods for calculating the cycles of heat engines. Obtaining basic knowledge about the designs of steam, water-heating and special boilers, steam and gas turbines in the scope of a general understanding of the technological scheme for the production of heat and electric energy, as well as an understanding of the organization of combustion of organic fuels in the combustion devices of boilers, of thermophysical and hydro-gas-dynamic processes occurring in gas-air and steam-water paths of the boiler plant, on the operating conditions of heat and power equipment, allowing the young specialist to further improve and independently make technical decisions.  **LEARNING OUTCOMES:**  **Bachelors know**: equilibrium state, equilibrium and reversible process, equations of states;  - stability of the state, the direction of irreversible processes;  - thermodynamic properties of pure substances and their mixtures;  - phase equilibrium, phase transitions;  - the beginnings of thermodynamics, the cycle and Carnot's theorems;  - differential equations of thermodynamics, total differentials of internal energy, enthalpy, entropy;  **are able**:  - to determine the thermodynamic properties of pure substances and their mixtures, their change in thermodynamic processes;  - calculate heat flows, temperature fields and thermal resistances for stationary and non-stationary heat conduction;  - to determine the heat transfer coefficient for natural and forced flow around bodies and flow in pipes and channels, as well as during phase transitions;  - calculate heat transfer by radiation and heat transfer with complex heat transfer;  - calculate heat transfer and determine heat losses of various elements of heat exchangers.  **COMPETENCES**:  - apply in practice methods for calculating thermal and caloric parameters of state, heat and work in thermodynamic processes of ideal, real gases, in wet steam and air;  - use in practice thermodynamic methods of analysis of physical and chemical processes. |
| **Content** | Thermal and industrial power stations as the main components of thermal power systems. Energy use in industrial and heat engineering production. Thermal power systems of the main sectors of the country's economy. Classification of heat power plants. Thermal engineering principles of work and energy characteristics of thermal power plants. Energy resources of heat engineering industries. Modes and schedules of heat consumption of an industrial enterprise. Classification of district heating systems. Heat sources in systems of centralized heat supply of industrial enterprises. Use of non-traditional heat sources and internal (secondary) energy resources. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Кириллин В.А., Сычев В.В., Шейндлин А.Е. Техническая термодинамика; Учебник.- М.: МЭИ, 2008.–496 с.  2. Сборник задач по технической термодинамике: Учебное пособие/Андрианова Т.Н., Дзампов Б.В., Зубарев В.Н., Ремизов С.А., Н.Я.Филатов.– М.: Издательство МЭИ, 2006. – 356 с.  3. Александров А.А., Б.А. Григорьев Таблицы теплофизических свойств воды и водяного пара. – М.:МЭИ, 2003.-168с.  4. Александров А.А. Термодинамические основы циклов теплоэнергетических установок.-М.,2006.-158с.  5. Темирбаев Д.Ж. Тепломассообмен: Учебное пособие для вузов. - Алматы: TST, 2009. -251 с.  6. Цветков Ф.Ф. Тепломассообмен. - М.: МЭИ, 2005. - 550с.  7. Задачник по тепломассообмену: учебное пособие/Ф.Ф.Цветков, Р.В.Керимов, В.И.Величко. М.: Издательство МЭИ, 2010.–196 с.  8. Теоретические основы теплотехники. Теплотехнический эксперимент: Справочник./Под общ. ред. А.В. Клименко, В.М. Зорина.- М.: Изд. МЭИ, 2007. - 564 с.  9. Теоретические основы теплоэнергетики [Текст]: Конспект лекций.- Алматы: АИЭС, 2002.- 80 с.  10. Основы современной энергетики [Текст]. Т.1. Современная теплоэнергетика: В 2-х т.:учебник / А.Д. Трухний [и др.]; под ред.Е.В.Аметистова; под ред.А.Д.Трухния.- 4-е изд., перераб.и доп.- М.: МЭИ, 2008.- 471с.  11. Елизаров Д.П. Тепловые электрические станции. М.: Энергоатомиздат, 2009. – 305 с. |

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| **Module name** | **MEE -В27-2 Fundamentals of heat supply** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Kibarin Andrey Anatolievich |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Heat engineering and basis of heat power engineering" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-30; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  o master the thermodynamic methods of analyzing the stability of the state and direction of processes in thermodynamic systems; to study the thermodynamic properties of substances, methods for calculating changes in thermal and caloric state parameters in the main equilibrium processes and cycles; to study the basic theoretical provisions, exact and approximate methods for solving the equations of heat and mass transfer processes.  **LEARNING OUTCOMES:**  **Bachelors know**:  - equilibrium state, equilibrium and reversible process, equations of states;  - stability of the state, the direction of irreversible processes;  - thermodynamic properties of pure substances and their mixtures;  - phase equilibrium, phase transitions;  - the beginnings of thermodynamics, the cycle and Carnot's theorems;  - differential equations of thermodynamics, total differentials of internal energy, enthalpy, entropy;  - reversibility and production of work, exergy of heat and flow;  - thermodynamics of gas flows;  - tables and diagrams of the state of water and steam;  **are able**:  - to determine the thermodynamic properties of pure substances and their mixtures, their change in thermodynamic processes;  - use the basic provisions and laws of thermodynamics for the analysis of physical and chemical processes;  - use tables and diagrams of the state of substances in the analysis of processes and cycles;  - calculate heat flows, temperature fields and thermal resistances for stationary and non-stationary heat conduction;  **COMPETENCES**:  - apply in practice methods for calculating thermal and caloric parameters of state, heat and work in thermodynamic processes of ideal, real gases, in wet steam and air;  - to use in practice the methods of calculation of thermal schemes. |
| **Content** | Basic concepts in the field of heat engineering and heat supply systems, including the basics of heat transfer processes, key concepts in the field of thermal power plants and technological schemes for the production, transport and distribution of thermal energy. Topics include issues of evaluating the effectiveness of basic thermodynamic processes, thermal power plants, the principles of their operation, the study of thermodynamic cycles and their effectiveness. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Кириллин В.А., Сычев В.В., Шейндлин А.Е. Техническая термодинамика; Учебник.- М.: МЭИ, 2008.–496 с.  2. Александров А.А. Термодинамические основы циклов теплоэнергетических установок.-М.,2006.-158с.  3. Темирбаев Д.Ж. Тепломассообмен: Учебное пособие для вузов. - Алматы: TST, 2009. -251 с.  4. Теоретические основы теплоэнергетики [Текст]: Конспект лекций.- Алматы: АИЭС, 2002.- 80 с.  5. Ильина Т.Н. Основы гидравлического расчета инженерных сетей.-М.:МЭИ, 2007.- 154 с.  6. Соколов Е.Я. Теплофикация и тепловые сети - М.: Издательство МЭИ, 2009. - 471 с.  7. Кудинов А.А. Тепловые электрические станции. Схемы и оборудование.-М.: «Инфра-М»,2013  8. Трухний А.Д. Теплофикационные паровые турбины и турбоустановки.-М.,2002  9. Основы современной энергетики [Текст]. Т.1. Современная теплоэнергетика: В 2-х т.:учебник / А.Д. Трухний [и др.]; под ред.Е.В.Аметистова; под ред.А.Д.Трухния.- 4-е изд., перераб.и доп.- М.: МЭИ, 2008.- 471с.  10. Елизаров Д.П. Тепловые электрические станции. М.: Энергоатомиздат, 2009. – 305 с. |

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| **Module name** | **MEE - В28-1 Analysis of electrical circuits and electromagnetic field** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Associate Professor Baimaganov Aliaskar Sainovich (Russian, English)  Senior Lecturer Arshabekova Alma Tulendievna (Kazakh language) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "The theory of nonlinear circuits and electromagnetic field" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  study of three-phase electrical circuits, non-linear circuits, as well as the theory of the electromagnetic field.  **LEARNING OUTCOMES:**  **Bachelors know**:  - schemes and formulas for calculation of three-phase circuits;  - basic laws of electrical circuits of non-sinusoidal current;  - diagrams and formulas for calculating non-linear circuits;  - basic laws of the electromagnetic field theory;  **are able**:  - apply theoretical knowledge to calculate three-phase circuits;  - apply theoretical knowledge to calculate non-linear circuits;  - apply methods of calculation according to the theory of electromagnetic field;  - to carry out experiments, calculation and processing of the obtained results.  **COMPETENCES**:  - calculate symmetrical and asymmetric modes in three-phase electrical installations;  - calculate and analyze sinusoidal and non-sinusoidal modes based on the laws of electromagnetic field theory;  - analyze reference and scientific literature, draw up technical documentation;  - test and test electrical devices.. |
| **Content** | a method for calculating asymmetric modes of three-phase circuits with a dynamic load by the method of symmetrical components; features of the analysis of electrical circuits at non-sinusoidal currents and voltages; analysis of non-linear circuits of direct and alternating currents; calculation of magnetic circuits; electromagnetic field theory. Consolidation of the acquired knowledge takes place in laboratory classes on the universal laboratory stands of UILS. The software products Mathcad, ElectronicsWorkbench are used. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. В. И. Денисенко, М. М. Аршидинов, А. С. Баймаганов, Г. К. Смагулова. Теория нелинейных цепей и электромагнитного поля. Методические указания и задания к РГР №1–3 для студентов по образовательной программе 6В07101 – Электроэнергетика. – Алматы: АУЭС, 2020. – 37 с. 2. М. М. Аршидинов, В. И. Денисенко, Г. К. Смагулова. Теория нелинейных цепей и электромагнитного поля. Методические указания и задания по выполнению лабораторных работ для студентов по образовательной программе 6В07101 – Электроэнергетика. – Алматы: АУЭС, 2020. – 33 с. 3. Бессонов Л. А. ТОЭ. Электромагнитное поле. – М., 2013. 4. Аполлонский С. М. ТОЭ. Электромагнитное поле. – СПб.: «Лань», 2012. 5. Башарин С. А. ТОЭ. Теория электрических цепей и электромагнитного поля. – М., 2010. 6. Аршидинов М. М., Денисенко В. И., Болдырева Л. П. Теоретические основы электротехники: Учебное пособие, АУЭС, Алматы, 2016. – 98 с. 7. В. И. Денисенко, С. Ю. Креслина. Теоретические основы электротехники 2. Конспект лекции (для студентов всех форм обучения специальности 050718 – Электроэнергетика). Алматы: АИЭС, 2007. – 62 с. 8. В. И. Денисенко, Г. М. Светашев. Теоретические основы электротехники 4. Конспект лекций для студентов всех форм обучения специальности 5B071800 – Электроэнергетика. – Алматы: АИЭС, 2010. – 86 с. |

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| **Module name** | **MEE -В28-2 The theory of nonlinear circuits and electromagnetic field** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Associate Professor Baimaganov Aliaskar Sainovich (Russian, English)  Senior Lecturer Arshabekova Alma Tulendievna (Kazakh language) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Analysis of electrical circuits and electromagnetic field" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  study of three-phase electrical circuits, non-linear circuits, as well as the theory of the electromagnetic field.  **LEARNING OUTCOMES:**  **Bachelors know**:  - schemes and formulas for calculation of three-phase circuits;  - basic laws of electrical circuits of non-sinusoidal current;  - diagrams and formulas for calculating non-linear circuits;  - basic laws of the electromagnetic field theory;  **are able**:  -apply theoretical knowledge to calculate three-phase circuits;  - apply theoretical knowledge to calculate non-linear circuits;  -apply methods of calculation according to the theory of electromagnetic field;  - to carry out experiments, calculation and processing of the obtained results.  **COMPETENCES**:  -calculate symmetrical and asymmetric modes in three-phase electrical installations;  - calculate and analyze sinusoidal and non-sinusoidal modes based on the laws of electromagnetic field theory;  - analyze reference and scientific literature, draw up technical documentation;  - test and test electrical devices. |
| **Content** | a method for calculating asymmetric modes of three-phase circuits with a dynamic load by the method of symmetrical components; features of the analysis of electrical circuits at non-sinusoidal currents and voltages; analysis of non-linear circuits of direct and alternating currents; calculation of magnetic circuits; electromagnetic field theory. Consolidation of the acquired knowledge takes place in laboratory classes on the universal laboratory stands of UILS. The software products Mathcad, ElectronicsWorkbench are used. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. В. И. Денисенко, М. М. Аршидинов, А. С. Баймаганов, Г. К. Смагулова. Теория нелинейных цепей и электромагнитного поля. Методические указания и задания к РГР №1–3 для студентов по образовательной программе 6В07101 – Электроэнергетика. – Алматы: АУЭС, 2020. – 37 с. 2. М. М. Аршидинов, В. И. Денисенко, Г. К. Смагулова. Теория нелинейных цепей и электромагнитного поля. Методические указания и задания по выполнению лабораторных работ для студентов по образовательной программе 6В07101 – Электроэнергетика. – Алматы: АУЭС, 2020. – 33 с. 3. Бессонов Л. А. ТОЭ. Электромагнитное поле. – М., 2013. 4. Аполлонский С. М. ТОЭ. Электромагнитное поле. – СПб.: «Лань», 2012. 5. Башарин С. А. ТОЭ. Теория электрических цепей и электромагнитного поля. – М., 2010. 6. Аршидинов М. М., Денисенко В. И., Болдырева Л. П. Теоретические основы электротехники: Учебное пособие, АУЭС, Алматы, 2016. – 98 с. 7. В. И. Денисенко, С. Ю. Креслина. Теоретические основы электротехники 2. Конспект лекции (для студентов всех форм обучения специальности 050718 – Электроэнергетика). Алматы: АИЭС, 2007. – 62 с. 8. В. И. Денисенко, Г. М. Светашев. Теоретические основы электротехники 4. Конспект лекций для студентов всех форм обучения специальности 5B071800 – Электроэнергетика. – Алматы: АИЭС, 2010. – 86 с. |

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| **Module name** | **MEE-В29 Work placement internship 1** |
| **Semester(s) in which the module is taught** | 4 |
| **Person responsible for the module** | Senior Lecturer Zhagyparov E.N. |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practicals works |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Practical classes – 150 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** The purpose of the industrial practice is the acquisition by students of a working profession - an electrician for the maintenance of electrical equipment (2nd category).  **LEARNING OUTCOMES:**  **Bachelors know**:  - basics of electrical engineering; the principle of operation of electric motors and generators of direct and alternating current, switchgear equipment and electrical appliances;  - the main types of electrical materials, their properties and purpose, techniques and methods for splicing and soldering low voltage wires; procedure and rules for turning on and off electric motors;  - rules for first aid in case of electric shock; power supply scheme and location of electrical equipment in the serviced area;  **are able**:- to charge and install lighting fixtures (normal and dustproof with incandescent lamps), as well as electric bells and other signaling devices; use universal and special devices, simple and medium complexity instrumentation.  - organize and carry out adjustment, adjustment and testing of electrical and electromechanical equipment.  **COMPETENCES:** - organize and perform maintenance and repair of electrical and electromechanical equipment;  - carry out diagnostics and technical control during the operation of electrical and electromechanical equipment. |
| **Content** | The basics are given for the organization and conduct of electrical work, the methods and stages of the installation of electrical equipment, acceptance documentation are studied, the skills of applying the acquired knowledge to solve specific engineering and technical problems are given. Familiarization of students with the organization and methods of installation and repair of electrical equipment of power stations and substations, the technology of installation and repair of cable and overhead lines |
| **Current control** | tests |
| **Final control** | Graded test |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Агафонов А. И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А. И. Агафонов, Т. Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл. 2. Менумеров, Р. М. Electrical safety: учеб. пособие / Р.М. Менумеров. - 4-е изд., стер. - СПб: Лань, 2020. - 196 с.  3. Электропривод типовых производственных механизмов: учеб. пособие / Ю. Н. Дементьев, В. М. Завьялов, Н.В. Кояин и др.; Томский политехнический ун-т. - М: Юрайт, 2020. - 404 с. - (Высшее образование)  4. Кудинов А. А., Тепловые электрические станции. Схемы и оборудование: учеб. пособие / А. А. Кудинов. - М.: ИНФРА-М, 2021. - 325 с.: ил. - (Высшее образование: Бакалавриат)  5. Лыкин А. В., Электроэнергетические системы и сети: учебник для вузов / А.В. Лыкин; Новосибирский государственный технический университет. - М.: Юрайт, 2020. - 360 с. - (Высшее образование)  6. <https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti_11.html>  7. <https://pro-rza.ru/> |

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| **Module name** | **MEE - В30-1 Computer network technologies in electrical engineering** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Golubeva Tatyana Viktorovna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Interfaces of computer systems in electrical engineering" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2, Информационно-коммуникационные технологии |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to provide students with knowledge about the internal structure of computer systems with a detailed study of interfaces in the electric power industry.  **LEARNING OUTCOMES:**  **Bachelors know**: - principles of data storage in the Windows registry;  - internal structure of computer systems;  - principles of operation of interfaces;  **are able**: Be able to competently carry out measurements, calibrate measuring instruments and calculate the measurement uncertainty; correctly process single and multiple measurements.  **COMPETENCES**: - Extracting and executing a command. Organization of work with input-output modules. |
| **Content** | Computer performance. The speed of the microprocessor. Component performance balance. The evolution of microprocessors.  Basic components and functions of a computer.  Communication between components via a backbone.  Highway structure. Hierarchy of highways  Functional characteristics of the highway design.  PCI and PCI-E trunks. The structure of highway lines. Highway teams.  Data session. Highway Arbitration.  Inner memory. Functions and characteristics of the subsystem  external memory. Storage of data on external media.  I/O modules. Functions, structure.  Operating system support. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Архитектура компьютера http://www.glossary.ru/cgi-bin/gl\_sch2.cgi?RAw)oylqyzw:!qusv;8ylwui  2 Назаров С.В., Широков А.И. - Современные операционные системы - Национальный Открытый Университет "ИНТУИТ" - 2016 - 351с. - ISBN: 978-5-9963-0416-5 - Текст электронный // ЭБС ЛАНЬ - URL: https://e.lanbook.com/book/100498.  3 А.В.Павлов, Архитектура вычислительных систем – СПб: Университет  ИТМО, 2016. – 86 с.  4 Новожилов, О. П. Архитектура компьютерных систем в 2 ч. Часть 1 : учебное пособие для среднего профессионального образования / О. П. Новожилов. — Москва : Издательство Юрайт, 2019. — 276 с. — (Профессиональное образование). — ISBN 978-5-534-10299-4. — Текст : электронный // Образовательная платформа Юрайт [сайт]. — URL: <https://urait.ru/bcode/442490>  5 Архитектура компьютера http://lab314.brsu.by/kmp-lite/kmp2/hard/Architecture/architecture.htm |

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| **Module name** | **MEE - В30-2 Interfaces of computer systems in electrical engineering** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Golubeva Tatyana Viktorovna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Computer network technologies in electrical engineering" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2, Информационно-коммуникационные технологии |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  obtaining knowledge about the internal structure of computer systems with a detailed study of interfaces in the electric power industry.  **LEARNING OUTCOMES:**  **Bachelors know**: - the possibilities of modern software for calculations and modeling in research;  - architecture and fundamentals of the functioning of computers, local and global computer networks, application software for engineering calculations, modeling and computer design of technological processes.  **are able**: - conduct research using modern applied programs;  - to use modern information technologies, equipment, applied software to solve professional problems, incl. in problems of computer design of technological processes.  **COMPETENCES**: Principles of building networks. Design of computer networks. Setting up networks. Network diagnostics and debugging. Problems of development of complex software systems. Software life cycle. Software development processes. Software architecture. Principles of creation of the user interface. Software development management. |
| **Content** | The concepts of building computer networks are studied, knowledge is formed on the layout of networks, the physical medium for data transmission, to give an idea of ​​the network architecture and network operation in control systems, the principles of building computer networks; The main types of network architectures, basic topologies and hardware components of computer networks, methods of access to the data transmission medium, basic technologies of local networks are studied. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Архитектура компьютера http://www.glossary.ru/cgi-bin/gl\_sch2.cgi?RAw)oylqyzw:!qusv;8ylwui  2 Назаров С.В., Широков А.И. - Современные операционные системы - Национальный Открытый Университет "ИНТУИТ" - 2016 - 351с. - ISBN: 978-5-9963-0416-5 - Текст электронный // ЭБС ЛАНЬ - URL: https://e.lanbook.com/book/100498.  3 А.В.Павлов, Архитектура вычислительных систем – СПб: Университет  ИТМО, 2016. – 86 с.  4 Новожилов, О. П. Архитектура компьютерных систем в 2 ч. Часть 1 : учебное пособие для среднего профессионального образования / О. П. Новожилов. — Москва : Издательство Юрайт, 2019. — 276 с. — (Профессиональное образование). — ISBN 978-5-534-10299-4. — Текст : электронный // Образовательная платформа Юрайт [сайт]. — URL: <https://urait.ru/bcode/442490>  5 Архитектура компьютера http://lab314.brsu.by/kmp-lite/kmp2/hard/Architecture/architecture.htm |

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| **Module name** | **MEE - В31 Electrical machines** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Senior Lecturer Yury Vladimirovich Kuzmin (Russian)  Cand.Tech.Sc, Associate Professor Gali Kakimzhan Oraluly (Kazakh) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and communication technology,  Theoretical basis of electrical engineering 2, Physics 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** students to study the principles of design and operation of electrical machines, transformers and gain knowledge about the operating modes of electrical machines, transformers..  **LEARNING OUTCOMES:**  **Bachelors know**:  - knowledge of the main elements of the electric drive and their characteristics.  - reasonable design, calculation and selection of elements of electric drive systems;  -analysis of reference and regulatory literature, preparation of technical documentation;  - drawing up an algorithm and a process control program.  **are able**:analyze steady and transient modes of operation of electrical machines and transformers.   * **COMPETENCES:**   - own the method of determining the parameters of electrical machines and transformers by calculation and experience,  - analyze the steady-state and transient modes of operation of electrical machines and transformers. |
| **Content** | The basics of the general theory of electrical machines, the principle of operation of various types of machines - transformers, asynchronous machines, synchronous machines and DC machines are considered. A brief description and design features of each type of electrical machines, their significance and scope are given. The performance characteristics of types of electrical machines are considered and on this basis conclusions are drawn about their advantages and disadvantages. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Р.М.Шидерова, К.О.Гали, А.Н.Бестерекова. Электрические машины. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика .- Алматы: АУЭС, 2015 – 81с. 2. П.И. Сагитов, Р.М. Шидерова, Н.К. Алмуратова. Электрические машины. Трансформаторы и машины постоянного тока. Методические  указания к лабораторным работам для специальности 5В071800. – Алматы: АУЭС, 2013. – 36с. 3. П.И. Сагитов, Р.М. Шидерова, Н.К. Алмуратова. Электрические машины. Синхронные и асинхронные машины. Методические  указания к выполнению лабораторных работ для студентов специальности 5В071800 - Электроэнергетика. – Алматы: АУЭС, 2014. –52с. 4. Вольдек А.И. Электрические машины. Электрические машины переменного тока. -СПб.: Питер, 2008.-352с. |

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| **Module name** | **MEE - В32-1 Electromechanical and electromagnetic transient processes** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | PhD Berdimurat Ainur Dastanovna |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Operating modes of synchronous generators" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2,  Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the theory of electromagnetic and electromechanical transients in case of violation of the operation mode of the electric power system  **LEARNING OUTCOMES:**  **Bachelors know**:  - change of parameters during normal transient conditions in the system;  - causes of occurrence of electromechanical transients;  - causes of electromagnetic transients;  - methodology for calculating the statistical stability of the system;  - method of dynamic stability of the system.  **are able**:  - draw up design equivalent circuits for calculating electromagnetic and electromechanical transients;  - calculate the parameters of the elements of the power system;  - to assess the dynamic stability of the electric power system.  **COMPETENCES**:  - have a clear understanding of the physics of electromagnetic and electromechanical transients;  - know the parameters of synchronous machines in transient conditions, the main characteristics of the short-circuit current, means of increasing the stability of power systems and the conditions for their selection;  - to evaluate the static stability margin for various types of automatic regulators. |
| **Content** | Analysis of operating modes of electrical networks and systems. Types of short-circuit currents and methods for their calculation. Measures to limit short-circuit currents. General information about sustainability. Static stability. Assumptions made in the stability analysis. Analysis of dynamic stability. Methods for calculating the stability of the system. Current-limiting reactors, bus sectioning, splitting of transformer windings. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Куликов Ю.А. Переходные процессы в электроэнергетических системах М.: «Омега-Л» 2013  2. Переходные процессы в электроэнергетических системах /под редакцией Крючкова И.П., и др./ М.: МЭИ 2009  3. Абдурахманов А.А., Мукашева-Рамазанова Т.У. Переходные процессы в электроэнергетике (Методические указания и задания к РГР-№1) Алматы, АУЭС 2013  4. Тохтибакиев К.К., Абдурахманов А.А., Тананова А. Электромагнитные и электромеханические переходные процессы. (МУ и задания к выполнению лабораторных работ №1и2) Алматы, АУЭС 2015  5. Умбеткулов Е.К., Абдурахманов А.А., Тананова А. . Электромагнитные и электромеханические переходные процессы.. (МУ и задания к РГР-№2,3). Алматы, АУЭС 2014  6. Тохтибакиев К.К.,Сажин В.Н. Электромагнитные и электромеханические переходные процессы. Методические указания и задания к выполнению расчетно-графических работ для студентов специальности 050718 – Электроэнергетика. Алматы: АИЭС, 2009.  7. Тохтибакиев К.К., Лавронов К.А. Электромагнитные и электромеханические переходные процессы. Методические указания к выполнению лабораторных работ для студентов специальности 050718 – Электроэнергетика. Алматы: АИЭС, 2007  8.Хрущев Ю.В., Электроэнергетические системы и сети. Электромеханические переходные процессы : учеб. пособие для прикладного бакалавриата / Ю.В. Хрущев, К.И. Заподовников, А.Ю. Юшков; Томский политехнический ун-т. - М. : Юрайт, 2019. - 154 с. - (Университеты России) |

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| **Module name** | **MEE - В32-2 Operating modes of synchronous generators** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Associate Professor Genbach N.A. (Russian)  Senior Lecturer Duisenova Sh.T. (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electromechanical and electromagnetic transient processes" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2,  Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  To study the physical laws that take place in generators in various modes, to ensure the correct maintenance of modes that guarantee the fulfillment of the main tasks of operation: covering the established maximum load, ensuring the reliable operation of power systems and its elements, maintaining the quality of electric energy at a given level.  **LEARNING OUTCOMES:**  **Bachelors know**:  -physical regularities in generators in various modes,  - the main tasks of the operation,  - ensuring reliable operation of the power system and its elements,  - maintaining the quality of electrical energy at a given level  **are able**:  - turn on synchronous generators for parallel operation manually and by the method of precise synchronization, self-synchronization and semi-automatic synchronization;  - redistribute loads between generators.  **COMPETENCES**:  - the ability to apply regulatory documents in practice, to be guided by them when solving technical issues of occurrence in various modes of operation of synchronous generators;  - the ability to determine possible options for protection against overloads;  - analyze and critically evaluate the operating modes of synchronous generators. |
| **Content** | Mastering theoretical knowledge in the field of turbine generator building and its current trends. Mastering knowledge about the operation of turbogenerators, their cooling and excitation systems. Distinguish between the modes of operation of synchronous generators and understand in what situation they are applicable. The study of the power diagram and the ability to analyze it. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Кудинов А. А., Тепловые электрические станции. Схемы и оборудование : учеб. пособие / А.А. Кудинов. - М. : ИНФРА-М, 2021. - 325 с.: ил. -(Высшее образование: Бакалавриат).  2. [Коломиец Н.В., Пономарчук Н.Р., Елгина Г.А. Режимы работы и эксплуатация электрооборудования электрических станций](https://www.twirpx.com/file/2778316/) Учебное пособие - Томск: Томский политехнический университет, 2015. – 80 с.  3. [Бродов Ю.М., Родионов И.Е., Ниренштейн М.А. Турбогенератор - это очень просто](https://www.twirpx.com/file/2242824/) . Учебное пособие; под общ. ред. д-ра техн. наук, проф. Ю. М. Бродова. — Екатеринбург: Изд-во Урал. ун-та, 2017. — 92 с.  4. Быстрицкий, Г.Ф. Общая энергетика. Основное оборудование: учебник для академ. бакалавриата / Г. Ф. Быстрицкий, Г.Г. Гасангаджиев, В.С. Кожиченков. - 2-е изд., испр. и доп. - М.: Юрайт, 2019  5. Кацман М.М. Электрические машины Учебник для студ. учреждений сред, проф. образования. — 12-е изд., стер. — М.: Академия, 2013. — 496 с.  6. ГОСТ IEC 60034-3-2015 Машины электрические вращающиеся. Часть 3. Специальные требования для синхронных генераторов, приводимых паровыми турбинами и турбинами на сжатом газе М.: Стандартинформ, 2016. – 24 с.  7. Ростик Г.В. Поддержание живучести турбогенераторов М.: НТФ Энергопрогресс, 2012 — 112 с.  8. Леньков Ю. А., Барукин А.С. Справочные материалы по измерительным трансформаторам и турбогенераторам. Алматы: CyberSmith, 2017. — 156 с. |

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| **Module name** | **MEE - В33-1 Electrical networks and systems** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Cand.Tech.Sc Uteshkalieva Lyazzat Shynbulatovna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Transmission of electrical energy" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  Studying the design features of elements of electrical networks and systems, mastering methods for calculating operating modes and ways to reduce electricity losses in electrical networks.  **LEARNING OUTCOMES:**  **Bachelors know**:  - design features of power lines and transformer  substations;  - modes of operation of electrical networks;  - methods of voltage regulation in electrical networks;  - ways to reduce the loss of electrical energy.  **are able**:  - draw up equivalent circuits for electrical networks and determine their parameters;  - calculate modes of simple, closed and complex-closed networks;  - carry out calculations of short-circuit currents and operating modes of electrical networks using RastrWin and PSCAD software systems;  - determine the loss of power and electricity.  **COMPETENCES**:  - the ability to draw up design schemes and equivalent circuits of electrical networks and their elements for subsequent calculations;  - calculate the modes of operation of electrical networks and systems;  - assess the admissibility and conditions for the stability of the electric power system;  - to determine by calculation the short-circuit currents in electrical networks;  - carry out the calculation of electrical networks using software and computer systems. |
| **Content** | The study of design features and physical principles of building electrical networks and systems. Mastering modern methods for calculating modes in electrical networks and systems. Basic requirements for the quality of electricity and ways to maintain them in electrical networks. Principles and means of frequency and voltage regulation. Application of RastrWin and PSCAD programs in the calculation of modes in electrical networks and systems. Optimization of operating modes in terms of reactive power and voltage. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Ананичева С.С., Электроэнергетические системы и сети. Примеры и задачи : учеб. пособие / С.С. Ананичева, С.Н. Шелюг; Уральский Федеральный ун-т имени первого Президента России Б. Н. Ельцина. - 2-е изд. - М. : Юрайт; Екатеринбург: Изд-во Урал. ун-та, 2020. - 180 с. - (Высшее образование)  2. Лыкин А. В., Электроэнергетические системы и сети : учебник для вузов / А.В. Лыкин; Новосибирский государственный технический университет. - М. : Юрайт, 2020. - 360 с. - (Высшее образование)  3. Ж.К. Оржанова, Н.А.Генбач. Электрические сети и системы. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика. – Алматы: АУЭС, 2019. – 63 с.  4. Соколов С.Е, Сажин В.Н, Н.А. Генбач Н.А. Электрические сети и системы. Учебное пособие. – Алматы: АИЭС, 2010.  5. Поспелов Г.Е., Федин В.Т., Лычев П.В. Электрические системы и сети. Учебник. — Мн.: Технопринт, 2004.-710 с.  6. Железко Ю.С. Потери электроэнергии. Реактивная мощность.  Качество электроэнергии. М.: ЭНАС, 2009. - 456 с.  7. Шведов Г.В., Сипачева О.В., Савченко О.В. Потери электроэнергии при ее транспорте по электрическим сетям: расчет, анализ, нормирование и снижение. Под ред. Железко Ю.С. — Учебное пособие для вузов. — М.: МЭИ, 2013.- 424 с.: ил. - ISBN 978-5-383-00832-4.  8. Ушаков В.Я., Электрические системы и сети: учеб. пособие для  СПО / В.Я. Ушаков; Томский политехнический ун-т. - М. : Юрайт, 2019. - 448с.  9. Крюков А.В. Определение потерь электроэнергии в электрических  сетях и системах электроснабжения. Иркутск, ИрГУПC, 2004 |

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| **Module name** | **MEE - В33-2 Transmission of electrical energy** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | PhD Berdimurat Ainur Dastanovna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electrical networks and systems" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to familiarize students with the general characteristics of transmission and distribution systems of electrical energy and to study the design features and modes of operation of electrical network elements.  **LEARNING OUTCOMES:**  **Bachelors know**:  - types and design features of power lines;  - features of energy transfer by alternating and direct current;  - modes of operation of electrical networks;  - active power balances and its connection with frequency control;  - balances of reactive power and its connection with voltage regulation;  - methods of voltage regulation in electrical networks;  - ways to reduce the loss of electrical energy.  **are able**:  - draw up equivalent circuits for electrical networks and determine their parameters;  - calculate modes of simple, closed and complex-closed networks;  - to carry out calculations of the operating modes of electrical networks using the software systems RastrWin and PSCAD .;  - determine the loss of power and electricity.  **COMPETENCES**:  - determine the parameters of electrical network equipment;  - the ability to calculate the modes of operation of electrical networks;  - develop measures to reduce electricity losses in electrical networks;  - Compile and execute standard technical documentation. |
| **Content** | Acquisition of knowledge about power transmission and distribution systems. Methods for determining the parameters of equivalent circuits for elements of an electrical system, operating modes of electric power systems, methods for calculating power and energy losses in elements of electrical networks, issues of the quality of electrical energy and its provision are being studied. Calculation of steady-state modes, optimization of the mode in terms of reactive power and voltage is performed by RastrWin and PSCAD software systems. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Лыкин А.В., Электрические системы и сети : учебник для СПО / А.В. Лыкин. - М. : Юрайт, 2019. – 364  2. Герасименко А.А., Федин В.Т. Передача и распределение электрической энергии. – Изд. 2-е – Ростов /нДону: Феникс, 2008. – 715, [2] с. – Высшее образование.  3. Евдокунин Г. А. Электрические системы и сети: учеб. пособие. — 4- е изд., испр. и доп. — СПб.: Родная Ладога, 2016. — 384 с.  4. Ж.К. Оржанова, Н.А.Генбач. Электрические сети и системы. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика. – Алматы: АУЭС, 2019. – 63 с.  5. Соколов С.Е, Сажин В.Н, Н.А. Генбач Н.А. Электрические сети и системы. Учебное пособие. – Алматы: АИЭС, 2010.  6. Ж.К.Оржанова, Н.А.Генбач. Электрические сети и системы. Методические указания к выполнению расчетно-графических работ для студентов специальности 5В071800 – Электроэнергетика. – Алматы: АУЭС, 2018. – 21с.  7. Ж.К.Оржанова, Н.А.Генбач. Электрические сети и системы.  Методические указания по выполнению лабораторных работ для студентов  специальности 5В071800 – Электроэнергетика. – Алматы:АУЭС, 2018. – 12.  8. Оржанова Ж.К., Утешкалиева Л.Ш. Электрические сети и системы. Сборник задач к практическим занятиям для студентов специальности 5В071800 – Электроэнергетика. – АУЭС: Алматы, 2017. |

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| **Module name** | **MEE - В34-1 Electrical devices and measuring technology** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Associate Professor Manapova Gulnar Dzhambulovna (Russian, Kazakh)  Senior lecturer Amangaliyev Yerlan Zingaleevich (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Switching devices and measurement of electrical quantities" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-30; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2, Theoretical basis of electrical engineering 2. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to acquaint students with electrical apparatus and measuring equipment used in the use of electrical energy, from its production, transmission, distribution and ending with consumption. Get knowledge about their purpose, main characteristics, areas of application, principles of operation, designs. Acquisition of skills in working with electrical apparatus and measuring equipment of the world's leading companies and their choice in practical activities.  **LEARNING OUTCOMES:**  **Bachelors know**:  - physical phenomena and laws underlying the principle of operation of electrical devices and measuring equipment (ED and ME);  - application of various types of ED and ME in power supply and power consumption systems;  - device and design features of various ED and ME, the principle of their action;  - methods for measuring basic electrical quantities;  **are able**:  - analyze the physical processes occurring in electrical circuits;  - evaluate the functional effectiveness of various types of ED and ME;  - to calculate the necessary parameters of ED and ME and their choice for specific conditions;  - conduct a study of the characteristics of ED and ME in the conditions of their operation, including the use of modern computer technologies.  **COMPETENCES**:  - the ability to carry out the calculation of parameters, characteristics and the choice of electrical apparatus and measuring equipment in specific conditions;  - the ability to use modern computer technologies and software in the study and selection of ED and ME;  - the ability to compare and analyze the functional features of modern electrical apparatus and measuring equipment;  - the ability to use practical skills of working with ED and ME in professional activities. |
| **Content** | The discipline aims to acquaint students with the classification of electrical devices used in the production, transmission, distribution and consumption of electrical energy, their design, characteristics and main parameters, principle of operation, selection conditions, as well as the principles of elementary tests. The discipline also introduces the main measuring devices: switchboard, measuring instruments with the function of transmitting information, multifunctional measuring instruments, modern instrument transformers.. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1.Латышенко К. П., Автоматизация измерений, контроля и испытаний. Практикум : учеб. пособие для вузов / К.П. Латышенко, В.В. Головин. - 3-е изд., испр. и доп. - М. : Юрайт, 2021. - 161с. - (Высшее образование)  2. Чунихин А.А. Электрические аппараты. Общий курс: учебник для вузов. - М.: Альянс, 2008. – 720 с.: ил.  3. Электрические и электронные аппараты. Учебник для вузов в 2 томах / под ред. А.Г. Годжелло, Ю. К. Розанова. –М.: изд-ий центр «Академия», 2010. - Т.1. Элек-тромеханические аппараты. – 352 с.  4. Электрические и электронные аппараты. Учебник для вузов в 2 томах / под ред. А.Г. Годжелло, Ю. К. Розанова. –М.: изд-ий центр «Академия», 2010. - Т.2. Элек-тронные аппараты. – 352 с.  5. Кляйн Р.Я. Электрические и электронные аппараты. Уч. пособие. Ч.1 «Физиче-ские явления в электрических аппаратах».–Томск:ТПУ,2000 г. – 97 с.  6. Кляйн Р.Я. Электрические и электронные аппараты. – Томск: изд-во Томского политехнического университета, 2009. - Ч. II: Электромеханические аппараты: учебное пособие. – 161 с.  7. Набатов К.А., Афонин В.В. Электрические аппараты распределительных устройств низкого напряжения / Учебное пособие. - Тамбов: ТГТУ, 2007.– 96 с.  8. Грачев А.С. Электрические аппараты: руководство по решению задач проектиро-вания электрических аппаратов. - Йошкар-Ола: Мар.гос. унив-т,2009. – 111 с. |

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| **Module name** | **MEE -В34-2 Switching devices and measurement of electrical quantities** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Associate Professor Manapova Gulnar Dzhambulovna (Russian, Kazakh)  Senior lecturer Amangaliyev Yerlan Zingaleevich (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electrical devices and measuring technology" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-30; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2, Theoretical basis of electrical engineering 2. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to acquaint students with low and high voltage switching devices (SD) used at various energy facilities. Get knowledge about their purpose, main technical characteristics, areas of application, operating principles, designs. Acquisition of skills in working with switching devices and their choice in practical activities. Obtain basic information about the physical essence of electrical measurements and devices of measuring instruments, device designs, methods for measuring basic electrical quantities.  **LEARNING OUTCOMES:**  **Bachelors know**:  - physical phenomena and laws underlying the principle of operation of SD;  - application of various types of SD in power supply and power consumption systems;  - device, functional properties and design features of various SD;  - measuring devices and methods for measuring the main electrical quantities;  **are able**:  - analyze the physical processes occurring in electrical circuits in normal and abnormal modes of operation;  - evaluate the functional efficiency of various types of SD for the normal functioning of electrical networks;  - to calculate the necessary SD parameters and their selection, taking into account the characteristics of energy facilities;  - to study the characteristics of SD in the conditions of their operation, including the use of modern computer technologies.  **COMPETENCES**:  - the ability to calculate the parameters, characteristics and choice of SD in specific conditions;  - the ability to use modern computer technology and software in the study of characteristics, calculation and selection of SD;  - the ability to compare and analyze the functional advantages of modern SD and technical measuring instruments;  - the ability to use practical skills in working with SD and measuring devices in professional activities. |
| **Content** | The discipline aims to acquaint students with electrical switching devices used in the production, transport, distribution and consumption of electrical energy; the principles of their operation, methods of extinguishing the electric arc, the design of these devices, as well as their main characteristics and selection conditions, test methods. The discipline also introduces the methods of measuring basic electrical quantities, the design and use of basic measuring devices, including electronic and digital, multifunctional instruments, modern instrument transformers. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1.Латышенко К. П., Автоматизация измерений, контроля и испытаний. Практикум : учеб. пособие для вузов / К.П. Латышенко, В.В. Головин. - 3-е изд., испр. и доп. - М. : Юрайт, 2021. - 161с. - (Высшее образование)  2. Чунихин А.А. Электрические аппараты. Общий курс: учебник для вузов. - М.: Альянс, 2008. – 720 с.: ил.  3. Электрические и электронные аппараты. Учебник для вузов в 2 томах / под ред. А.Г. Годжелло, Ю. К. Розанова. –М.: изд-ий центр «Академия», 2010. - Т.1. Элек-тромеханические аппараты. – 352 с.  4. Электрические и электронные аппараты. Учебник для вузов в 2 томах / под ред. А.Г. Годжелло, Ю. К. Розанова. –М.: изд-ий центр «Академия», 2010. - Т.2. Элек-тронные аппараты. – 352 с.  5. Кляйн Р.Я. Электрические и электронные аппараты. Уч. пособие. Ч.1 «Физиче-ские явления в электрических аппаратах».–Томск:ТПУ,2000 г. – 97 с.  6. Кляйн Р.Я. Электрические и электронные аппараты. – Томск: изд-во Томского политехнического университета, 2009. - Ч. II: Электромеханические аппараты: учебное пособие. – 161 с.  7 Набатов К.А., Афонин В.В. Электрические аппараты распределительных устройств низкого напряжения / Учебное пособие. - Тамбов: ТГТУ, 2007.– 96 с.  8. Грачев А.С. Электрические аппараты: руководство по решению задач проектиро-вания электрических аппаратов. - Йошкар-Ола: Мар.гос. унив-т,2009. – 111 с. |

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| **Module name** | **MEE - В35-1 Fundamentals of relay protection in electric power systems** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Senior teacher Agimov Talgat Nurlanovich (kaz)  Associate professor Bashkirov Mikhail Vladimirovich (rus)  Senior lecturer Merenkov Murat Dyusengalievich (eng) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with " Element base of relay protection " |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and communication technology,  Theoretical basis of electrical engineering |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  Mastering the knowledge of the basics of relay protection technology, as well as the assimilation by students of the principles of protecting both individual elements and the system as a whole, as well as the basic provisions for calculating relay protection systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the basic principles for the implementation of relay protection, as well as the features of its use for the protection of individual elements of the electrical system;  - the principle of operation and schemes of relay protection of high-voltage power lines, power transformers.  **are able**:  - to read relay protection schemes and secondary circuit diagrams;  - to calculate the settings of the main and backup protections.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - analyze and critically evaluate the design advantages and disadvantages of various relay protection and automation devices offered for operation by various manufacturers. |
| **Content** | The theoretical foundations of modern relay protection technology, the requirements for relay protection devices, the principles of constructing relay protection circuits, the features of their operation and the choice of parameters are studied. Information is provided on modern and prospective directions in the development of relay protection, the scope of various types of relay protection, on the main problems of the transition from electromechanical relays to digital relay protection terminals; The skills of working with digital relay protection terminals of the world's leading companies in 10-35kV networks are acquired using software test systems. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1. Агафонов А. И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А. И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл. 2. Дьяков А. Ф., Платонов В. В. Основы проектирования релейной защиты электроэнергетических систем: Учебное пособие. - М.: Издательство МЭИ, 2010.- 248с., ил.  3. Булычев А. В., Наволочный А.А. Релейная защита в распределительных электрических сетях.: пособие для практических расчетов/А. В. Булычев, А.А., Наволочный. -М.: ЭНАС, 2011. -208с..: ил.  4. М. В. Башкиров, Мерекенов М.Д. Основы релейной защиты. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика – Алматы: АУЭС, 2016. - 68с.  5. Н. Н. Арыстанов, Т. Н. Агимов. Основы релейной защиты электроэнергетических систем. Методические указания и задания к выполнению лабараторных работ для студентов всех форм обучения специальности 5В071800 – Алматы: АУЭС, 2016 – 53 с. Печ. Алматы:АЭжБУ, 2016 - 53 с.  6. <https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti_11.html>  7. <https://pro-rza.ru/> |

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| **Module name** | **MEE - В35-2 Element base of relay protection** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Senior teacher Agimov Talgat Nurlanovich (kaz)  Associate professor Bashkirov Mikhail Vladimirovich (rus)  Senior lecturer Merenkov Murat Dyusengalievich (eng) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Fundamentals of relay protection in electric power systems" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and communication technology,  Theoretical basis of electrical engineering.  Mathematics |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge among undergraduates in the field of building relay protection of electric power systems, principles of operation and technical implementation, methodology for calculating the parameters of operation of relay protection.  **LEARNING OUTCOMES:**  **Bachelors know**:  - element base of relay protection  - theory, principles of operation and design of relay protection and automation systems;  - methods for calculating the operation parameters of relay protection and automation devices.  **are able**:  - choose the type of relay protection and automation in relation to a specific electric power facility;  - calculate the operation parameters of relay protection and automation devices.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - the ability to determine possible options for the implementation of relay protection and automation of a power facility;  - analyze and critically evaluate the protective capability of the designed relay protection;  - ability to assess the state and operating conditions of relay protection and automation of a power facility. |
| **Content** | The element base of relay protection, the principle of operation and schemes of relay protection of overhead power lines, cable lines, power transformers, the principle of operation of digital terminals are being studied. The skills of working with digital relay protection terminals of the world's leading companies in 10-35 kV networks are acquired using RETOM51, RETOM21 software test systems. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1. Агафонов А. И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А. И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл. 2. Дьяков А. Ф., Платонов В. В. Основы проектирования релейной защиты электроэнергетических систем: Учебное пособие. - М.: Издательство МЭИ, 2010.- 248с., ил.  3. Булычев А. В., Наволочный А.А. Релейная защита в распределительных электрических сетях.: пособие для практических расчетов/А. В. Булычев, А.А., Наволочный. -М.: ЭНАС, 2011. -208с..: ил.  4. М. В. Башкиров, Мерекенов М.Д. Основы релейной защиты. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика – Алматы: АУЭС, 2016. - 68с.  5. Н. Н. Арыстанов, Т. Н. Агимов. Fundamentals of relay protection in electric power systems. Методические указания и задания к выполнению лабараторных работ для студентов всех форм обучения специальности 5В071800 – Алматы: АУЭС, 2016 – 53 с. Печ. Алматы:АЭжБУ, 2016 - 53 с.  6. <https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti_11.html>  7. <https://pro-rza.ru/> |

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| **Module name** | **MEE -В36 Electric power supply** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Senior lecturer Agimov Talgat Nurlanovich (Kazakh)  Associate professor Kazanina Irina Vladimirovna (Russian)  Senior lecturer Soltanayev Abylaikhan Mukhituly (English) |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 2, Physics 2, Introduction to the specialty, Theoretical basis of electrical engineering 2, Electrical machines. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** The discipline aims to study the fundamentals of generation, transmission and distribution of energy, the characteristics of electricity consumers, the requirements for the reliability of systems, the switching and protection devices used, and the choice of equipment..  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main indicators for determining electrical loads;  - principle of operation and design features of protective equipment;  - physical phenomena occurring during reactive power compensation;  - ways of distribution of electric energy on the territory of the enterprise with a voltage of 6-10 kV;  - characteristics of industrial consumers of electricity.  **are able**:  - analyze electricity metering processes;  - evaluate the effectiveness of protective measures for electrical safety;  - to calculate electrical loads by various methods.  **COMPETENCES:**  - plan and set research objectives;  - choose methods of experimental work;  - interpret and present the results of scientific research. |
| **Content** | The principles of calculation of electrical loads at different voltage levels are studied; ways to compensate for reactive power, the choice of power and instrument transformers, the basics of drawing up single-line diagrams. Characteristics of electricity consumers, features of work, place in the power supply system, necessary power supply reliability, on which the accepted power sources, power supply schemes, applied switching and protection devices depend. |
| **Current control** | Course works -1, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Сивков А. А., Основы электроснабжения : учеб. пособие / А.А. Сивков, А.С. Сайгаш, Д.Ю. Герасимов; Томский политехнический ин-т. - 2-е изд., испр. и доп. - М. : Юрайт, 2020. - 174 с. - (Высшее образование; НИТПУ)1. 2. 2. Кудрин Б.И. Электроснабжение промышленных предприятий: Учебник для студентов высших учебных заведений /Б.И. Кудрин. – М.: Интермет Инжиниринг, 2011.  3. Киреева Э.А. Справочные материалы по электрооборудованию (цеховые электрические сети, электрические сети жилых и общественных зданий), 2004.  4. Правила устройства электроустановок. – СПб.: Издательство ДЕАН, 2007.  5. Казанина И.В., Живаева О.П. Электроснабжение. Методические указания и задания к выполнению курсовой работы для студентов всех форм обучения специальности 5В071800 - Электроэнергетика - Алматы: АУЭС, 2013.  8. Казанина И.В., Асанова К.М., Жунусова Г.С. Электроснабжение. Методические указания к выполнению лабораторных работ для студентов всех форм обучения специальности 5В071800 - Электроэнергетика - Алматы: АУЭС, 2017.  9. Конюхова Е.А. Электроснабжение. Учебник для студентов высших учебных заведений. - М.: МЭИ, 2014.  10 <https://www.chitai-gorod.ru/catalog/book/931019/>  11. <http://list-of-lit.ru/elektro/elektrosnabjenie.htm> |

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| **Module name** | **MEE - В37-1 Electric drive** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Professor Mustafin Marat Askarovich (Russian)  Cand.Tech.Sc, Associate Professor Gali Kakimzhan Oraluly (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electromechanical energy converters" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Theory of automatic control /Automatic control systems, Electrical machines |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the knowledge of the properties and characteristics of automated electric drive systems, methods for calculating parameters, static and dynamic characteristics of the electric drive, selecting its elements.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the principle of operation and design features of electric drives for general industrial purposes;  - physical phenomena occurring in controlled electromechanical converters;  - main characteristics of electric drives;  - ways to control the coordinates of the electric drive;  - the principle of operation of converters used in a modern electric drive;  - electromechanical and operational characteristics of DC and AC electric drive systems;  **are able**:  - evaluate the efficiency and choose the type of electric drive for specific mechanisms;  - to analyze the processes of managing technological processes by means of an automated electric drive.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - read and draw up control schemes for an automated electric drive;  - carry out preliminary calculation of parameters and selection of the main elements of the electric drive. |
| **Content** | The discipline studies the structures, characteristics and modes of operation of various automated electric drive systems. Methods for calculating parameters, static and dynamic characteristics, and selecting elements of an automated electric drive for various purposes are considered.  Theoretical knowledge is supported by a powerful laboratory workshop. Modern stands with the use of proven techniques allow you to acquire skills in working with automated electric drives from leading manufacturers |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Электропривод типовых производственных механизмов : учеб. пособие / Ю.Н. Дементьев, В.М. Завьялов, Н.В. Кояин и др.; Томский политехнический ун-т. - М : Юрайт, 2020. - 404 с. - (Высшее образование)  2. Лезнов Б.С. Частотно-регулируемый электропривод насосных установок. М.:»Машиностроение», 2013.-176с.  3. Мустафин М.А., Алмуратова Н.К. Электропривод. Методические указания к выполнению курсовой работы.- Алматы: АУЭС, 2017.-34с.  4. П.И.Сагитов, Р.М.Шидерова, Н.К.Алмуратова Электропривод. Методические указания к выполнению лабораторных работ для студентов специальности «Электроэнергетика».-Алматы: - АУЭС, 2014-34с.  5. Копылов И.П. Электрические машины.-М.: Энергоатомиздат, 2000.  6. Ковчин С.А., Сабинин Ю.А. Теория электропривода.- СПб.: Энергоатомиздат. Санкт – Петербургское отд. 2006.- 496 с.  7. <https://drives.ru/novosti/leznov/>  8. <https://portal.tpu.ru/SHARED/a/ACH/students/Tab1/Electrical_drive.pdf> |

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| **Module name** | **MEE - В37-2 Electromechanical energy converters** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Professor Mustafin Marat Askarovich (Russian)  Cand.Tech.Sc, Associate Professor Gali Kakimzhan Oraluly (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electric drive" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Theory of automatic control /Automatic control systems, Electrical machines |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the knowledge of the properties and characteristics of controlled electromechanical systems, methods for calculating parameters, static and dynamic characteristics, choosing systems and elements of electromechanical converters.  **LEARNING OUTCOMES:**  **Bachelors know**:  - principles of controlled electromechanical energy conversion;  - physical phenomena occurring in controlled electromechanical converters;  - electromechanical and mechanical characteristics of electric drives of direct and alternating current;  - energy and operational characteristics of controlled electromechanical systems;  **are able**:  - select and analyze circuits of valve converters for controlling electromechanical converters;  - evaluate the efficiency and choose the type of electric drive for specific mechanisms;  - to analyze the processes of managing technological processes by means of an automated electric drive.  **COMPETENCES**:  - apply normative documents in practice, be guided by them when - apply in practice regulatory documents, solving technical issues of production;  - read and draw up control schemes for electromechanical converters;  - carry out preliminary calculation of parameters and selection of the main elements of the electric drive. |
| **Content** | The discipline studies the structures, characteristics and modes of operation of various systems of electromechanical energy conversion. Methods for calculating parameters, static and dynamic characteristics, and selecting elements of electromechanical converters for various purposes are considered.  Theoretical knowledge is supported by a powerful laboratory workshop. Modern stands with the use of proven techniques allow you to acquire skills in working with engines and converters from leading manufacturers. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Электропривод типовых производственных механизмов : учеб. пособие / Ю.Н. Дементьев, В.М. Завьялов, Н.В. Кояин и др.; Томский политехнический ун-т. - М : Юрайт, 2020. - 404 с. - (Высшее образование)  2. Лезнов Б.С. Частотно-регулируемый электропривод насосных установок. М.:»Машиностроение», 2013.-176с.  3. Мустафин М.А., Алмуратова Н.К. Электропривод. Методические указания к выполнению курсовой работы.- Алматы: АУЭС, 2017.-34с.  4. П.И.Сагитов, Р.М.Шидерова, Н.К.Алмуратова Электропривод. Методические указания к выполнению лабораторных работ для студентов специальности «Электроэнергетика».-Алматы: - АУЭС, 2014-34с.  5.Копылов И.П. Электрические машины.-М.: Энергоатомиздат, 2000.  6. Ковчин С.А., Сабинин Ю.А. Теория электропривода.- СПб.: Энергоатомиздат. Санкт – Петербургское отд. 2006.- 496 с.  7. <https://drives.ru/novosti/leznov/>  8. <https://portal.tpu.ru/SHARED/a/ACH/students/Tab1/Electrical_drive.pdf> |

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| **Module name** | **MEE - В38-1 Electrical power stations** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Cand.Tech.Sc Mikhalkova Elena Grigorievna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Basic and auxiliary equipment of electrical power stations" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Physics 2, Theoretical basis of electrical engineering 2. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge among bachelors on the generation of electricity at large power plants and the modes of operation of their equipment; on methods for calculating short-circuit currents and choosing the main electrical equipment.  **LEARNING OUTCOMES:**  **Bachelors know**:  - classification of power plants, generation structure by types of fuel;  - technological process of production of electrical energy at power stations;  - design features and modes of operation of synchronous generators, power transformers and autotransformers;  - the basics of the transient process in case of a short circuit in electrical installations;  - methods for calculating short-circuit currents and choosing the main electrical equipment of power stations and substations;  - the main schemes of power plants and substations and the design of switchgears;  **are able**:  - draw up structural diagrams of power plants;  - choose generators and power transformers;  - to calculate short-circuit currents in electrical installations;  - select and check the equipment of stations and substations;  - develop diagrams of the main electrical connections.  **COMPETENCES**: - are able to apply normative documents in practice, be guided by them when solving technical issues of production;  - to determine possible options for constructing schemes of power plants;  - analyze and critically evaluate the options for adopted technical solutions;  - ability to assess the state and operating conditions of electrical equipment of power plants.. |
| **Content** | The discipline introduces undergraduates to the basics of legal metrology, the basics of technical regulation, the State system for ensuring the uniformity of measurements; as well as with international recommendations for estimating the uncertainty of measurement results, methods for calculating measurement uncertainty and their application in the calibration of measuring instruments. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Вантеев А.И., Обслуживание электрических подстанций: теория и практика : учеб. пособие / А.И. Вантеев. - М : Инфра-Инженерия, 2021; Вологда. - 368 с.:ил.,  табл.  2. Рожкова Л.Д., Козулин B.C. Электрооборудование электрических станций и подстанций: Учебник для сред. Проф. Образования/Л.Д. Рожкова, Л.К. Карнеев, Т.В. Чирков. –4-е изд., стер. М.: Издательский центр «Академия», 2007. – 448 с.  3. Хожин Г.Х., Михалкова Е.Г., Соколова И.С. Электрические станции и подстанции. Конспект лекций для студентов всех форм обучения специальности 050718 – Электроэнергетика. – Алматы: АУЭС, 2016. – 59 с.  4. Дукенбаев К. «Энергетика Казахстана» /К. Дукенбаев. – Алматы: Servis Press, 2016. – 492 с.  6. Расчет коротких замыканий и выбор электрооборудования: учеб. пособие для студ. высших. учеб.заведений/И.П. Крючков, Б.Н. Неклепаев, В.А. Старшинов и др.: под ред. И.П. Крючкова и В.А. Старшинова. – 3-е изд. стер. – М.: Издательский центр «Академия», 2008. – 416 с.  7. С.Е. Соколов, Г.Х. Хожин, Е.Г. Михалкова. Методические указания к расчетно-графической работе № 1 для студентов специальностей 050718 – Электроэнергетика и 5В081200 – Энергообеспечение сельского хозяйства – Алматы: АУЭС, 2014. – 15 с.  8. С.Е. Соколов, Г.Х. Хожин, Е.Г. Михалкова. Методические указания к расчетно-графической работе № 2 для студентов специальностей 050718 – Электроэнергетика и 5В081200 – Энергообеспечение сельского хозяйства – Алматы: АУЭС, 2014. – 16 с.  9 С.Е. Соколов, Г.Х. Хожин, Е.Г. Михалкова. Методические указания к расчетно-графической работе № 3 для студентов специальностей 050718 – Электроэнергетика и 5В081200 – Энергообеспечение сельского хозяйства – Алматы: АУЭС, 2014. – 25 с.  11. Е.Г. Михалкова, И.С. Соколова. Методические указания по выполнению лабораторных работ по курсу «Электрические станции и подстанции» для студентов специальности 5В071800 - Электроэнергетика. - Алматы: НАО АУЭС, 2020. - 35 с. |

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| **Module name** | **MEE - В38-2 Basic and auxiliary equipment of electrical power stations** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Cand.Tech.Sc Mikhalkova Elena Grigorievna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Electrical power stations" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Physics 2, Theoretical basis of electrical engineering 2. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  To study the design and operation of synchronous generators, power transformers and autotransformers; electrical equipment for own needs of power plants, methods for selecting and testing high voltage devices and current-carrying parts.  **LEARNING OUTCOMES:**  **Bachelors know**:  - classification and schematic diagrams of excitation systems of synchronous generators;  - operating modes of transformers and autotransformers;  - methods for calculating three-phase short circuit currents;  - design conditions for the selection and verification of electrical equipment of power plants;  - purpose and design of the main and auxiliary equipment;  - main schemes of power plants and own needs.  **are able**:  - make a choice of generators;  - distinguish between excitation circuits of synchronous generators;  - draw up structural diagrams of power plants;  - choose the main electrical equipment of the stations;  - calculate short circuit currents,  - to select and check switching devices and current-carrying parts;  - draw up diagrams of electrical connections of switchgears and auxiliary needs of power plants.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - the ability to determine possible options for constructing schemes of power plants;  - analyze and critically evaluate the options for adopted technical solutions;  - ability to assess the state and operating conditions of the main and auxiliary electrical equipment of power plants. |
| **Content** | Acquisition of knowledge about power transmission and distribution systems. Methods for determining the parameters of equivalent circuits for elements of an electrical system, operating modes of electric power systems, methods for calculating power and energy losses in elements of electrical networks, issues of the quality of electrical energy and its provision are being studied. Calculation of steady-state modes, optimization of the mode in terms of reactive power and voltage is performed by RastrWin and PSCAD software systems. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Вантеев А.И., Обслуживание электрических подстанций: теория и практика : учеб. пособие / А.И. Вантеев. - М : Инфра-Инженерия, 2021; Вологда. - 368 с.:ил., табл..  2. Рожкова Л.Д., Козулин B.C. Электрооборудование электрических станций и подстанций: Учебник для сред. Проф. Образования/Л.Д. Рожкова, Л.К. Карнеев, Т.В. Чирков. –4-е изд., стер. М.: Издательский центр «Академия», 2007. – 448 с.  3. Кузембаева Р.М., Соколов С.Е., Мукашева Р.Т.Основное и вспомогательное оборудование электрических станций и подстанций. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика, 5В071200 – Энергообеспечение сельского хозяйства – Алматы: НАО АУЭС, 2013. – 56 с. 4.  4. Расчет коротких замыканий и выбор электрооборудования: учеб. пособие для студ. высших. учеб.заведений/И.П. Крючков, Б.Н. Неклепаев, В.А. Старшинов и др.: под ред. И.П. Крючкова и В.А. Старшинова. – 3-е изд. стер. – М.: Издательский центр «Академия», 2008. – 416 с.  5. С.Е. Соколов, Г.Х. Хожин, Е.Г. Михалкова. Основное вспомогательное оборудование электрических станций и подстанций. Методические указания по выполнению расчетно-графических работ для студентов специальностей 5В071800 – Электроэнергетика. – Алматы: АУЭС, 2014. – 48 с.  6. С.Е. Соколов, Г.Х.Хожин., Ю.Г. Черемисинов. Изучение ячейки 210 кВ вакуумного выключателя. Методические указания к выполнению лабораторных работ для студентов всех форм обучения специальностей 050718 – Электроэнергетика. – Аламты: АУЭС, 2015. – 17 с.  7. Соколов С.Е.,Хожин Г.Х., Кузембаева Р.М., Сулейменова Д.Т. Основное и вспомогательное оборудование станций и подстанций. Методические указания к выполнению лабораторных работ для студентов всех форм обучения специальностей 050718 – Электроэнергетика. – Алматы: АУЭС, 2011. – 46 с.  8. Е.Г. Михалкова, И.С. Соколова. Методические указания по выполнению лабораторных работ по курсу «Электрические станции и подстанции» для студентов специальности 5В071800 - Электроэнергетика. - Алматы: НАО АУЭС, 2020. - 35 с. |

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| **Module name** | **MEE -В39-1 High Voltage Engineering** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | PhD Amitov Ernar Tanirbergenuly |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Insulation of electrical equipment and high voltage electrical installations" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  To study the issues of the occurrence of electrical discharges on the insulation of high-voltage electrical equipment, the principle of operation of a pulse voltage generator, the features of an electrical discharge in gaseous, liquid and solid dielectrics and methods for protecting electrical equipment from atmospheric overvoltages.  **LEARNING OUTCOMES:**  **Bachelors know**:  - classification and types of surges;  - conditions for the occurrence of electrical discharges on insulation  high-voltage electrical equipment;  - general characteristics of insulation breakdown;  - the principle of operation of the pulse voltage generator;  - the design and principle of operation of protective devices.  **are able**:  - to calculate the length of the leakage current of the external insulation of high-voltage electrical equipment;  - draw up block diagrams with protective devices applied to them;  - to calculate and recommend the place of installation of protection devices against atmospheric surges;  - calculate and test lightning protection of substations.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - the ability to determine possible emergency situations for the design of overhead power lines and bushings of high-voltage equipment of a power facility;  - evaluate the state of insulation of high-voltage electrical equipment. |
| **Content** | Influence of high and ultrahigh voltage on the electrical equipment of power stations and electrical networks. Methods for monitoring and testing high-voltage insulation. Studying the designs of insulators and testing them with overvoltage. Calculation and testing of lightning protection of transformer substations. Use in laboratory work of the pulse voltage generator up to 1000 kV of the firm "TUR" (Germany) |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Электрофизические основы техники высоких напряжений: учеб. для вузов / И. М. Бортник [и др.]; под общ. ред. И. П. Верещагина. – 2-е изд., перераб. и доп. – М.: Издательский дом МЭИ, 2010. – 704 с.  2. Техника высоких напряжений. Под ред. Кучинского Г.С. С-П.: Энергоатомиздат, 2003 г., 607 с.  3. Егоров В.В. Техника высоких напряжений. Перенапряжения в устройствах электрической тяги. Профилактические испытания изоляции: Учебное пособие для вузов ж-д. транспорта. – М.: Маршрут, 2004. – 188 с.  Дополнительная:  4. Правила технической эксплуатации электроустановок потребителей и правила безопасности при эксплуатации электроустановок потребителей. М.: Энергоатомиздат, 2003.  5. Инструкция по устройству молниезащиты зданий, сооружений и промышленных коммуникаций. – М: изд-во МЭИ, 2004. – 29 с.  6. Колечицкий Е.С. Основы расчета заземляющих устройств. – М: изд-во МЭИ, 2003.  7. Горелов, С. В. Изоляция и перенапряжения в системах электроснабжения: учеб. пособие: Часть 1/ С. В. Горелов, Л. Н. Татьянченко, С. О. Хомутов. – Барнаул: Алт. гос. техн. ун-т им. И. И. Ползунова, 2002. – 116 с.  8. Техника высоких напряжений. Учебное пособие. Борисов В.Н. – Алматы: АИЭС, 2006г.  9. Техника высоких напряжений. Перенапряжения и изоляция. Конспект лекций.Борисов В.Н., Оржанова Ж.К. – Алматы:АИЭС, 2006г. |

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| **Module name** | **MEE - В39-2 Insulation of electrical equipment and high voltage electrical installations** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | PhD Amitov Ernar Tanirbergenuly |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "High Voltage Engineering" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  Formation of knowledge about the processes of violation of external and internal insulation, principles and methods for diagnosing and testing the insulation of electrical equipment and high voltage electrical installations.  **LEARNING OUTCOMES:**  **Bachelors know**:  - features of external and internal insulation of high-voltage electrical installations;  - the main electrophysical processes occurring in insulating structures under the influence of high voltages;  - types of impact on insulation during the operation of electrical equipment;  - conditions for compliance with the properties of insulation during operation;  - the main methods and means of testing the insulation of high-voltage electrical installations.  **are able**: - measure high voltage;  - use protective equipment when working on high-voltage electrical installations;  - analyze the influence of various factors on the electrical strength and arrangement of insulating structures;  - test the insulation of high-voltage electrical equipment.  **COMPETENCES**:  - is able to use technical means of diagnostics and testing of insulation of high-voltage electrical equipment;  - assess the electrical strength of external and internal insulation of electrical equipment;  - independently carry out technical control and assessment of the performance of the insulation of electrical equipment. |
| **Content** | Studying the behavior of gaseous, liquid and solid dielectrics in electrostatic fields, methods for monitoring and testing high-voltage insulation, the basics of designing external insulation of power lines, substations and other high-voltage equipment, high-voltage test facilities, high-voltage insulation test methods, principles for measuring high voltages, measures and insulating structures for high voltage protection. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Электрофизические основы техники высоких напряжений: учеб. для вузов / И. М. Бортник [и др.]; под общ. ред. И. П. Верещагина. – 2-е изд., перераб. и доп. – М.: Издательский дом МЭИ, 2010. – 704 с.  2. Техника высоких напряжений. Под ред. Кучинского Г.С. С-П.: Энергоатомиздат, 2003 г., 607 с.  3. Егоров В.В. Техника высоких напряжений. Перенапряжения в устройствах электрической тяги. Профилактические испытания изоляции: Учебное пособие для вузов ж-д. транспорта. – М.: Маршрут, 2004. – 188 с.  4. Правила технической эксплуатации электроустановок потребителей и правила безопасности при эксплуатации электроустановок потребителей. М.: Энергоатомиздат, 2003.  5.Инструкция по устройству молниезащиты зданий, сооружений и промышленных коммуникаций. – М: изд-во МЭИ, 2004. – 29 с.  6. Колечицкий Е.С. Основы расчета заземляющих устройств. – М: изд-во МЭИ, 2003.  7. Горелов, С. В. Изоляция и перенапряжения в системах электроснабжения: учеб. пособие: Часть 1/ С. В. Горелов, Л. Н. Татьянченко, С. О. Хомутов. – Барнаул: Алт. гос. техн. ун-т им. И. И. Ползунова, 2002. – 116 с.  8. Техника высоких напряжений. Учебное пособие. Борисов В.Н. – Алматы: АИЭС, 2006г.  9. Техника высоких напряжений. Перенапряжения и изоляция. Конспект лекций. Борисов В.Н., Оржанова Ж.К. – Алматы:АИЭС, 2006г. |

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| **Module name** | **MEE - В40-1 Logical foundations of digital control systems** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Professor Mustafin Marat Askarovich (Russian)  Senior lecturer Darkembayeva Elmira Baizhumaevna (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Mathematical foundations of digital control systems" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Theory of automatic control /Automatic control systems |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the basic laws and functions of the algebra of logic, the characteristics of the main logical elements, the rules for conducting logical operations, the construction and optimization of logical circuits and tools for their implementation; obtaining the skills to analyze and synthesize logical schemes and operations and the skills to implement them in industrial practice.  **LEARNING OUTCOMES:**  **Bachelors know**:  - modern and perspective directions of development of digital control systems;  - basic laws and functions of Boolean algebra and instrumental ways of their implementation;  - methods for minimizing logic functions and circuits;  - device and principle of operation of basic logical elements and devices;  **are able**:  - carry out logical operations, analyze and synthesize logical circuits and operations;  - to implement logical functions on basic elements and devices using the basic laws of logic algebra.  **COMPETENCES**:  - read and draw up logical control schemes;  - describe operations using logical variables and symbols of logical operations;  - choose logic elements of digital control circuits. |
| **Content** | The basic concepts of the algebra of logic, the characteristics and properties of basic and integrated logic elements, the use of computer mathematical applications for solving logic problems, the rules and instrumentation base for the synthesis of logic circuits and operations in the electric power industry and electrical engineering based on basic and integrated logic elements, programmable logic controllers, application laws and functions of the algebra of logic in automatic control and diagnostic systems at electric power facilities. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Чашкин А.В. Дискретная математика. Учебник для вузов.- М.:Академия, 2012.  2. Новиков Ю.В. Введение в цифровую схемотехнику. - Интернет Ун-т Информационных технологий, 2012.  3. Сборник задач по дискретной математике. Для практических занятий в группах: Ю. П. Шевелев, Л. А. Писаренко, М. Ю. Шевелев — Санкт-Петербург, Лань, 2013 г.- 528 с.  4. Мустафин М.А., Бестерекова А.Н. Логические основы цифровых систем управления. Конспект лекций. – АУЭС, 2019.  5. Мустафин М.А., Кузьмин Ю.В., Даркенбаева Э.Б. Логические основы цифровых систем управления. Методические указания к выполнению лабораторных работ. АУЭС, 2019 (каз.).  6. Мустафин М.А., Жаркинбекова М.Б. Чныбаева Д.М. Логические основы цифровых систем управления. Методические указания к выполнению расчетно-графических работ. АУЭС, 2019 (рус.).  7. Собакин Е.Л. Цифровая схемотехника. Учеб. пособие. Ч.I.  Томск: Изд. ТПУ, 2002. - 160с.  Интернет ресурсы  8. http://electrik.info Аладышкин Б. Статьи о булевой алгебре для электриков.  9. http://globalteka.ru/books/doc\_details/15431  10.https://antaresbook.xyz/books/sbornik-zadach-po-diskretnoy-atematike-dlya-prakticheskih-zanyatiy-v-gruppah |

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| **Module name** | **MEE - В40-2 Mathematical foundations of digital control systems** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Professor Mustafin Marat Askarovich (Russian)  Senior lecturer Darkembayeva Elmira Baizhumaevna (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Logical foundations of digital control systems" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Theory of automatic control /Automatic control systems |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  students mastering the mathematical foundations, rules and laws of the algebra of logic, the nomenclature of the applied logical elements, the rules for conducting logical operations, methods for constructing and optimizing logic circuits; obtaining the skills to analyze and synthesize logical circuits and operations and the skills of their application in electrical engineering, automation and electromechanics.  **LEARNING OUTCOMES:**  **Bachelors know**:  - modern and perspective directions of development of digital control systems;  - basic concepts, laws and functions of Boolean algebra;  - instrumental methods for implementing logical operations;  - methods for minimizing logic functions and circuits;  **are able**:  - use mathematical logical operations in relay protection, automation, diagnostics systems  - analyze and synthesize logic circuits and operations;  - to implement logical functions on basic elements and devices.  **COMPETENCES**:  - to make a mathematical description of logical control schemes;  - describe operations using logical variables and symbols of logical operations;  - choose logical elements and devices for the implementation of digital control schemes. |
| **Content** | Study the basic laws and operations of logic algebra, methods for minimizing logic functions, optimizing the number and range of basic and integrated logic elements, mathematical description, circuit and instrumental implementation of logic operations, rules for analyzing and synthesizing logic circuits and operations in the electric power industry and electrical engineering, the use of programmable logic controllers, elements of mathematical logic in computer mathematical applications. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Чашкин А.В. Дискретная математика. Учебник для вузов.- М.:Академия, 2012.  2. Новиков Ю.В. Введение в цифровую схемотехнику. - Интернет Ун-т Информационных технологий, 2012.  3. Сборник задач по дискретной математике. Для практических занятий в группах: Ю. П. Шевелев, Л. А. Писаренко, М. Ю. Шевелев — Санкт-Петербург, Лань, 2013 г.- 528 с.  4. Мустафин М.А., Бестерекова А.Н. Логические основы цифровых систем управления. Конспект лекций. – АУЭС, 2019.  5. Мустафин М.А., Кузьмин Ю.В., Даркенбаева Э.Б. Логические основы цифровых систем управления. Методические указания к выполнению лабораторных работ. АУЭС, 2019 (каз.).  6. Мустафин М.А., Жаркинбекова М.Б. Чныбаева Д.М. Логические основы цифровых систем управления. Методические указания к выполнению расчетно-графических работ. АУЭС, 2019 (рус.).  7. Собакин Е.Л. Цифровая схемотехника. Учеб. пособие. Ч.I. Томск: Изд. ТПУ, 2002. - 160с.  Интернет ресурсы  8. http://electrik.info Аладышкин Б. Статьи о булевой алгебре для электриков.  9. http://globalteka.ru/books/doc\_details/15431  10.https://antaresbook.xyz/books/sbornik-zadach-po-diskretnoy-atematike-dlya-prakticheskih-zanyatiy-v-gruppah |

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| **Module name** | **MEE -В41 Work placement internship 2** |
| **Semester(s) in which the module is taught** | 6 |
| **Person responsible for the module** | Head of department Tergemes K. T.,  Head of department Umbetkulov E.K.,  Head of department Shynybai Zh.S. |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practicals works |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Practical classes – 150 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Work placement internship 1 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to study at a particular enterprise the issues of production, transmission and distribution of electricity, the installation of relay protection and automation systems (RPA) of equipment and automation of power systems, familiarization with the schedule for scheduled preventive maintenance, to gain practical skills in their implementation.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main technological process of the enterprise;  - electrical equipment of power electrical installations and electrical substations, their modes of operation, circuit diagrams;  **are able**:- apply advanced methods of labor and production;  - apply teamwork skills, competencies of corporate management principles.  **COMPETENCES:** - understand the essence and social significance of your future profession, show a steady interest in it  - organize their own activities, choose standard methods and methods for performing professional tasks, evaluate their effectiveness and quality  - use information and communication technologies in professional activities. |
| **Content** | Maintenance of electrical equipment of power stations, networks and systems.  Operation of electrical equipment of power stations, networks and systems.  Control and management of technological processes.  Diagnostics of the state of electrical equipment of power stations, networks and systems. Organization and management of a team of performers, characteristics of electricity consumers, features of work, place in the power supply system, the necessary power supply reliability, on which the accepted power sources, power supply schemes, and switching and protection devices used depend. |
| **Current control** | tests |
| **Final control** | Graded test |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Агафонов А. И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А. И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл. 2. Менумеров, Р. М. Electrical safety : учеб. пособие / Р.М. Менумеров. - 4-е изд., стер. - СПб : Лань, 2020. - 196 с.  3. Электропривод типовых производственных механизмов : учеб. пособие / Ю.Н. Дементьев, В.М. Завьялов, Н.В. Кояин и др.; Томский политехнический ун-т. - М : Юрайт, 2020. - 404 с. - (Высшее образование)  4. Кудинов А. А., Тепловые электрические станции. Схемы и оборудование : учеб. пособие / А.А. Кудинов. - М. : ИНФРА-М, 2021. - 325 с.: ил. - (Высшее образование: Бакалавриат)  5. Лыкин А. В., Электроэнергетические системы и сети : учебник для вузов / А.В. Лыкин; Новосибирский государственный технический университет. - М. : Юрайт, 2020. - 360 с. - (Высшее образование)  6. <https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti_11.html>  7. <https://pro-rza.ru/> |

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| **Module name** | **MEE - В42-1 Labor Protection** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate Professor Abikenova Asel Amangeldievna (Russian, Kazakh)  PhD Begimbetova Ainur Serikbaevna (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Industrial Safety" |
| **Teaching methods** | Lectures, practical works, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes -15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2,  Техника безопасности в электроустановках/ Electrical safety |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of students' professional knowledge on issues of labor protection and safety, industrial sanitation, fire safety in electrical installations.  **LEARNING OUTCOMES:**  **Bachelors know**:  -features of ensuring safe working conditions in the field of professional activity, legal, regulatory and organizational framework for labor protection in the organization;  -safety regulations for the operation of electrical installations.  **are able**: analyze traumatic and harmful factors in the field of professional activity.  **COMPETENCES**: apply in practice regulatory documents, be guided by them when solving technical issues of production. |
| **Content** | The basics of regulatory and legal support of safety and labor protection in the Republic of Kazakhstan, factors of the working environment and indicators of the labor process, as parameters that form working conditions in the workplace, methods and means to ensure optimal working conditions are being studied. Safety rules for the maintenance of electrical installations, the basics of organizing fire protection at work, fire prevention and preventive measures during the operation of electrical installations. At practical and laboratory classes, the means and methods of measuring production factors, assessing working conditions in terms of the severity and intensity of the labor process are studied. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Беляков, Г. И. Охрана труда и техника безопасности : учебник для СПО / Г. И. Беляков. — 3-е изд., пер. и доп. — М. : Издательство Юрайт, 2018. — 404 с. — (Серия : Профессиональное образование). —Режим доступа:https://biblio-online.ru 3.  2. Беляков, Г. И. Пожарная безопасность : учебное пособие для СПО / Г. И. 3. 3. Беляков. — М. : Издательство Юрайт, 2018. — 143 с. — (Серия : Профессиональное образование). — Режим доступа: https://biblio-online.ru 4  4. Сибикин, Ю.Д Охрана труда и электробезопасность.,.М.: РадиоСофт, 2014 г.  5. Аипов А.К Охрана труда и безопасность жизнедеятельности.,Астана.: «КазУЭФМТ», 2013г; |

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| **Module name** | **MEE - В42-2 Industrial Safety** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate Professor Abikenova Asel Amangeldievna (Russian, Kazakh)  PhD Begimbetova Ainur Serikbaevna (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Labor Protection" |
| **Teaching methods** | Lectures, practical works, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes -15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2,  Техника безопасности в электроустановках/ Electrical safety |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  show the need to use a systematic approach when studying the issues of ensuring requirements  safety and labor protection, develop the ability to use normative and legal acts containing safety and labor protection standards. To study methods and means of preventing and reducing risks in the workplace and in technological processes.  **LEARNING OUTCOMES:**  **Bachelors know**:  -industrial safety systems;  -electrical installation safety systems;  -fire extinguishing methods and means;  -sources of dangerous and harmful production factors of modern technological processes.  **are able**:  -analyze and evaluate hazardous and harmful production factors of technological processes and equipment;  -use legal and regulatory and technical documentation on labor safety issues.  **COMPETENCES**: apply in practice regulatory documents, be guided by them when solving technical issues of production. |
| **Content** | The requirements for the safe operation of power equipment, methods and means of ensuring the safety of technological processes, methods for analyzing the causes of industrial injuries, the procedure for identifying individual occupational risk, and the impact of working conditions on the level of electrical injuries are studied. Measures of protection against electric shock during the operation of electrical installations, fire prevention measures during the operation of electrical installations. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Беляков, Г. И. Охрана труда и техника безопасности : учебник для СПО / Г. И. Беляков. — 3-е изд., пер. и доп. — М. : Издательство Юрайт, 2018. — 404 с. — (Серия : Профессиональное образование). —Режим доступа:https://biblio-online.ru 3.  2. Беляков, Г. И. Пожарная безопасность : учебное пособие для СПО / Г. И. 3. 3. Беляков. — М. : Издательство Юрайт, 2018. — 143 с. — (Серия : Профессиональное образование). — Режим доступа: https://biblio-online.ru 4  4. Сибикин, Ю.Д Охрана труда и электробезопасность.,.М.: РадиоСофт, 2014 г.  5. Аипов А.К Охрана труда и безопасность жизнедеятельности.,Астана.: «КазУЭФМТ», 2013г; |

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| **Module name** | **MEE - В43 Installation and repair of electric equipment of power stations** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Cand.Tech.Sc, associate professor Umbetkulov Ertugan Kozhagulovich |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  **Specialisation** |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Physics 2, Electrotechnical materials science/ Electrotechnical materials and products, Electrical power stations/ Basic and auxiliary equipment of electrical power stations |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to familiarize students with the features of the organization of installation and repair of electrical and electromechanical equipment of power plants. Organization and structure of electrical repair production at power stations. Types of repairs.  **LEARNING OUTCOMES:**  **Bachelors know**:  - design, principle and modes of operation of the main and auxiliary electrical equipment of power plants;  - technology of maintenance, installation and repair of electrical equipment;  - mechanisms and devices for performing electrical work at power stations;  - the structure of electrical repair production at power plants;  - types and content of repair of electrical equipment.  **are able**:  - operate mechanisms and devices for performing electrical work at power plants;  - carry out fault detection and pre-repair tests of electrical machines;  - carry out installation and repair work of the main and auxiliary electrical equipment;  - to organize the structure of electrical repair production;  - to introduce effective systems for the installation and repair of electrical equipment.  **COMPETENCES**:  - to apply normative documents in practice, to be guided by them  during installation and repair of the main and auxiliary electrical equipment of power plants;  - to carry out pre-repair tests and fault detection of electrical machines;  - the ability to determine effective options for the use of mechanisms and devices for electrical work;  - to create an optimal structure of electrical repair production. |
| **Content** | The discipline considers the organization of installation and repair of electrical and electromechanical equipment, features of the installation technology of transformers, switches, disconnectors and electric machines for the station's own needs. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Грунтович Н.В., Монтаж, наладка и эксплуатация электрооборудования : учеб. пособие / Н.В. Грунтович. - Минск : Новое знание, 2019; М.: ИНФРА-М, 2019. - 271 с. - (Высшее образование: Бакалавриат)  2. Куценко Г.Ф. Монтаж, эксплуатация и ремонт электроустановок:  практическое пособие. – Мн.: Дизайн ПРО, 2006.  3. Доценко В.А., Сивков А.А., Герасимов Д.Ю. Монтаж, ремонт и эксплуатация электрических распределительных сетей в системах электроснабжения промышленных предприятий: Учебное пособие.- Томск: Изд. ТПУ, 2007.  4. Полуянович Н.К. Монтаж, наладка, эксплуатация и ремонт систем  электроснабжения промышленных предприятий: Учебное пособие. - Таганрог: Изд-во ТТИ ЮФУ, 2007.  5. Справочник по строительству и реконструкции линий электропередачи напряжением 0,4 - 750 кВ /Под ред. Гологорского Е.Г.- М.: Из-во НЦ  ЭНАС, 2008.  6. Соколов С.Е, Сажин В.Н., Генбач Н.А. Электрические сети и системы: Учебное пособие. – АУЭС, 2010.  7. Грунтович Н.В. Монтаж, наладка и эксплуатация электрооборудования: учеб. пособие / Н.В. Грунтович. - Минск: Новое знание, 2019;  8. Полищук В. И., Эксплуатация, диагностика и ремонт электрооборудования: учеб. пособие / В.И. Полищук. - М.: ИНФРА-М, 2020. - 203с. |

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| **Module name** | **MEE -В44 Designing of electrical power stations** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Cand.tech.Sc. Mikhalkova Elena Grigorievna |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Physics 2, Electrotechnical materials science/ Electrotechnical materials and products, Electrical power stations/ Basic and auxiliary equipment of electrical power stations |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge among bachelors in the field of designing modern power plants, layout of buildings and equipment, selection of electrical circuits and electrical equipment of power plants.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the content and features of the design of power plants;  - basic principles for the selection of thermal mechanical equipment;  - methods of limiting short-circuit currents;  - power supply schemes for own needs of various power plants and their features;  - principles of construction of power supply schemes for auxiliary needs of stations.  **are able**:  - draw up structural diagrams of power plants and select power transformers;  - to calculate short circuit currents and select the main equipment of power plants;  - draw up diagrams of switchgear and power supply systems for the own needs of power plants.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - the ability to determine possible options for the design of power plants;  - analyze and critically evaluate the options for adopted technical solutions;  - the ability to assess the state and operating conditions of the electrical equipment of the designed power plants. |
| **Content** | Familiarization with the content of work on the design of various types of power plants and the basic principles of their layout; construction of the main scheme of the station and switchgear schemes; methods of limiting short-circuit currents; method of selection, verification of equipment and current-carrying parts; designing power supply for own needs of stations, switchgear and feasibility study of decisions made. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Балаков Ю.Н. Мисриханов М.Ш., Шунтов А.В. Проектирование схем электроустановок. Учебное пособие для вузов. – 2-е изд., стереот. -М.: Издательский дом МЭИ, 2006. – 288 с., ил.  2. С.Е.Соколов, Е.Г. Михалкова, Е.К. Умбеткулов. Проектирование электрических станций. Конспект лекций для специальности 5В071800 – Электроэнергетика. - Алматы: НАО АУЭС, 2017.- 77 с.  3. Рожкова Л.Д., Козулин B.C. Электрооборудование электрических станций и подстанций: Учебник для сред. Проф. Образования/Л.Д. Рожкова, Л.К. Карнеев, Т.В. Чирков. –4-е изд., стер. М.: Издательский центр «Академия», 2007. – 448 с.  4. Расчет коротких замыканий и выбор электрооборудования: учеб. пособие для студ. высших. учеб.заведений/И.П. Крючков, Б.Н. Неклепаев, В.А. Старшинов и др.: под ред. И.П. Крючкова и В.А. Старшинова. – 3-е изд. стер. – М.: Издательский центр «Академия», 2008. – 416 с.  5. С.Е. Соколов, Е.К. Умбеткулов, Е.Г. Михалкова. Методические указания по выполнению курсового проекта для студентов специальности 5В071800 – Электроэнергетика. - Алматы: НАО АУЭС, 2018.-21 с.  . |

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| **Module name** | **MEE -В45 Electrical energy storage** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Cand.Tech.Sc, associate professor Umbetkulov Ertugan Kozhagulovich |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  **Specialisation** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Physics 2, Electrotechnical materials science/ Electrotechnical materials and products, Electrical power stations/ Basic and auxiliary equipment of electrical power stations |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to study the devices and the principle of operation of energy storage devices. Formation of knowledge among bachelors on technical implementation and calculation of parameters of electric energy storage devices in various electric power systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the place of energy storage devices in technical progress;  - characteristics of electric energy storage devices and their functions;  - areas of application of electrical energy storage devices;  - modes of operation of electric energy storage devices;  - differences between electrical energy storage devices;  - problems solved with the help of energy storage devices in electric power systems.  **are able**: -  draw up and distinguish between graphs of electrical loads;  - compare and select the required type of electrical energy storage devices for specific systems;  - substantiate the modes of operation of electric energy storage devices;  - modeling electric energy storage devices,  - calculate the economic efficiency of using energy storage devices.  **COMPETENCES**: - apply in practice regulatory documents to be guided by them when solving technical issues of production;  - select the required type of electrical energy storage devices for specific systems;  - calculate the economic efficiency of the use of energy storage devices. |
| **Content** | Preconditions for the use of electrical energy storage devices in the electric power industry. The main design features of electric energy storage devices used in renewable energy sources. Capacitive storage. Electrochemical capacitors and their applications. Electromechanical energy storage devices. Comparison of types of energy storage devices. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Хрусталёв Д. А. Аккумуляторы. М: Изумруд, 2003;  2. А.Рыкованов, Системы баланса литий-ионных батарей// Силовая  электроника, 1(2009), С. 52-55;  3. Каменев Ю.Б. Оценка перспективности свинцово-кислотных  аккумуляторов. Сборник научн. Трудов по свинцовым аккумуляторам ЗАО  «Электротяга»., С.-Пб,Химиздат, 2005, с. 13-62;  4. F. Rahman, M. Skyllas-Kazacos, Vanadium Redox Battery: Positive Half-Cell Electrolyte Studies, Journal of Power Sources (2008);  5. Vanadium Redox Flow Batteries: An In-Depth Analysis. EPRI, Palo Alto, CA: 2007. 1014836;  6. Андреев В.М., Забродский А.Г., Когновицкий С.О., Интегрированная  энергоустановка с накопителем энергии на основе водородного цикла,  Международный журнал «Альтернативная энергетика и экология» АЭЭ №2  (46), 2007,99-105;  7. К.Г.Большаков и др., Альтернативная энергетика и экология, № 4 (24),  2005 г., стр. 52-57  8. https://drive.google.com/drive/folders/17h8h6kFLz3jVaLxsrlOzk0VR-  \_DLoEXn?usp=sharing |

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| **Module name** | **MEE -В46 Operation of electrical equipment of power plants** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Cand.tech.Sc. Mikhalkova Elena Grigorievna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Electrotechnical materials science/ Electrotechnical materials and products, Electrical power stations/ Basic and auxiliary equipment of electrical power stations |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of bachelors knowledge in the field of operation of electrical equipment of power plants, the study of the principles and methods of building effective systems for the maintenance and repair of equipment and the basics of production management.  **LEARNING OUTCOMES:**  **Bachelors know**:  - features of operation of power equipment of power plants;  - causes and consequences of electrical equipment failures;  - the structure of the repair cycle, the types and frequency of repair work on the electrical equipment of the stations;  - principles of formation of electrical services;  - issues of operation of the main and auxiliary electrical equipment of power plants;  - safety precautions in the production of works.  **are able**:  - classify the causes of electrical equipment failures;  - to analyze the basic concepts of the theory of reliability;  - apply practical skills in the operation of electrical equipment of power plants;  - analyze the operating modes of the equipment and improve their efficiency.  **COMPETENCES**:  - the ability to apply normative documents in practice, to be guided by them when solving technical issues of production;  - make decisions on the operation of the main and auxiliary equipment of power plants;  - analyze and critically evaluate the options for adopted technical solutions;  - assess the condition and operating conditions of electrical equipment of power plants. |
| **Content** | Acquaintance with the purpose and design of the main and auxiliary electrical equipment of power plants. Features of the operation of electrical equipment of power plants. Drawing up a schedule of preventive work. Standards for technical inspection and current repair of electrical equipment. Methods of prevention and diagnostics of electrical equipment. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Калентионок, Е. В. Оперативное управление в энергосистемах: учеб, пособие / Е.В. Калентионок, В.Г. Прокопенко, В.Т. Федин ; под общ. ред. В.Т. Федина. — Минск; Выш. шк., 2007. — 351 с . : ил. 2. Грунтович Н.В., Монтаж, наладка и эксплуатация электрооборудования: учеб. пособие / Н.В. Грунтович. - Минск: Новое знание, 2019; М.: ИНФРА-М, 2019. - 271 с. - (Высшее образование: Бакалавриат) 3. Основы эксплуатации электрооборудования: Учебное пособие / Составитель М.И.Успенский. – Сыктывкар: СЛИ, 2006. – 53 с. 4. Красник В.В. Эксплутация электрических подстанций и распределительных устройств.М.: Энас., 2012 г. 5. Михалкова Е.Г. Эксплуатация электрооборудования электрических станций. МУ и задания к выполнению расчетно-графических работ. Алматы, «НАО АУЭС им. Г. Даукеева», 2021 г. - 30 с. 6. Васильева В.Я., Дробиков Г.А., Лагутин В.А. Эксплуатация электрооборудования электрических станций и подстанций: Учеб пособие. - Чебоксары: Изд-во Чуваш. ун-та, 2000. - 864 с. 7. Голодновя О.С. Основные причины отказов турбогенераторов и пути их предупреждения: Учебно-методическое пособие. — М.: ИПКгосслужбы, 2005. — 92 с. 8. Электротехнический справочник: в 4 т. Т.3. Производство и распределение электрической энергии / под общ. ред. В. Г. Герасимова и др. – 8-е изд., испр. и доп. – М.: Изд-во МЭИ, 2002. – 964 с. 9. Правила устройств электроустановок Республики Казахстан (ПУЭ) <https://online.zakon.kz/document/?doc_id=30013634#pos=7;-118> |

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| **Module name** | **MEE -В47 - Basics of Building a SCADA System in the electrical engineering** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate professor, PhD Orakbaev E.Zh. (Kazakh.)  Senior lecturer Adilova Sh.K. (Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-30; Practical classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Philosophy, Sociology, Culturology, Psychology cultural studies |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to familiarize students with modern components of industrial SCADA systems, to study methods for building effective systems for automatic and automated process control in the electric power industry, using SCADA software and hardware systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - principles of construction of industrial SCADA-systems and interfaces;  - device, principle of operation and main characteristics of programmable industrial controllers operating under the control of SCADA systems;  - structure and functionality of modern industrial SCADA systems;  **are able**:  - to program microprocessor controllers for the implementation of typical functions of automatic control systems;  - to program industrial controllers for implementation of standard functions of control systems;  - design control systems based on modern technical means and industrial SCADA systems.   * **COMPETENCES:**   - ability to use modern SCADA information technologies, manage information using business application programs;  - ability to use network computer technologies;  - ability to participate in the development of projects for the electrical part of the power plant (substation);  - ability to use computer-aided design of electrical installations;  - ability to build industrial SCADA systems. |
| **Content** | Formation of the idea of ​​information security as a stable state of security of information, its carriers and infrastructure, which ensures the integrity and stability of processes associated with information, to intentional or unintentional impacts of a natural and artificial nature, information is given about modern components of SCADA systems. Study of methods for constructing effective systems for automatic and automated process control using SCADA software and hardware systems. The principles of building industrial SCADA systems, industrial interfaces and controllers operating under the control of SCADA systems, the device, principle of operation and main characteristics of programmable technological controllers, structures and functionality of modern technological SCADA systems are studied. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Шильмагамбетова Ж.Ж., Программирование в SCADA-системах : учеб. пособие / Ж.Ж. Шильмагамбетова, В.Н. Казагачев. - Алматы : Эверо, 2021. - 208 с.  2 Кангин В.В., Разработка SCADA-систем : учеб. пособие / В.В. Кангин, М.В. Кангин, Д.Н. Ямолдинов. - М. : Инфра-Инженерия, 2019; Вологда. - 564с.: ил., табл.  3 Основы построения SCADA систем [Текст] : Метод.указ. по вып. лаб. раб. для студ. спец. 5В070200-Автоматизация и управление / НАО АУЭС, Каф. инженерной кибернетики, сост.: Ж.Ж. Омирбекова, Н.Р. Токтасынова, А.Д. Нурахынова. - Алматы : АУЭС, 2017. - 50с: 3,06 уч.-изд.л.   1. Кангин В.В., Разработка SCADA-систем : учеб. пособие / В.В. Кангин, М.В. Кангин, Д.Н. Ямолдинов. - М. : Инфра-Инженерия, 2019; Вологда. - 564с.: ил., табл. 2. Проектирование АСУТП в SCADA-системе TACE MODE [Электронный ресурс] : учеб. пособие. - Таганрог: Изд-во ТТИ ЮФУ, 2007. 3. Андреев Е.Б., Куцевич Н.А., Синенко О. В.. SCADA-системы: взгляд изнутри. - М.: Издательство «РТСофт», 2004. - 176 с: ил. 4. <http://www.ste.ru/siemens/pdf/rus/08_WinCC_62_r.pdf> 5. <https://new.siemens.com/kz/ru.html> 6. <https://mall.industry.siemens.com/mall/ru/ru/Catalog/Products/10007460> 7. <https://www.ptsecurity.com/upload/corporate/ru-ru/analytics/WINCC-Compliance-v2-3a-rus.pdf> 8. <https://insat.ru/products/?category=1631>   <https://insat.ru/products/?category=9> |

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| **Module name** | **MEE -В48 Operation, maintenance and repair of electrical equipment of electrical networks** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate professor Genbach Natalya Alekseevna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Electrotechnical materials science/ Electrotechnical materials and products, Electrical power stations/ Basic and auxiliary equipment of electrical power stations |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of bachelors' knowledge in the field of operation, maintenance and improvement of the reliability of electrical equipment of electrical networks and systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - issues of operation of electrical equipment;  - classification and schematic diagrams of electrical networks and systems;  - structural elements of overhead lines;  -technologies for current and capital repairs;  - know the principles of the formation of electrical services of electrical networks;  **are able**:  - classify the causes of electrical equipment failures,  - analyze the basic concepts in the definition of reliability theory,  -experience in operating and repairing electrical equipment  -electrical networks, analyze the modes of operation of networks and manage them, improve efficiency, reliability and quality of electricity.  **COMPETENCES**:  - understand the difference between operational and maintenance personnel;  - analyze reference and normative literature;  - organize scheduled preventive and current repairs;  - to develop and draw up technical documentation for operational and repair work. |
| **Content** | The study of the designs of the main electrical equipment of electrical networks. Features of the operation of high-voltage electrical equipment. Standards for technical inspection and current repair of electrical equipment of overhead lines and transformer substations. Methods of prevention and diagnostics of electrical equipment. General requirements for the operation of electrical equipment. Principles of formation of electrical services. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Krasnik V.V. Operation of electrical substations and distribution devices. M .: Enas., 2012  2. Gruntovich N.V., Installation, adjustment and operation of electrical equipment: textbook. allowance / N.V. Gruntovich. - Minsk: New knowledge, 2019; M.: INFRA-M, 2019. - 271 p. - (Higher Education: Undergraduate)  3.Mikheev G.M. Power plants and electrical networks. Diagnostics and control of electrical equipment. M.: Dodeka., 2010  4. Eroshenko G.P. and other operation of electrical equipment. M.: Kolos, 2005  5. Korotkevich M.A. Operation of electrical networks. Minsk, 2005  6. Ovcharenko N.I. Automation of power stations and electric power systems. Moscow: Higher school, 2003  7. Makarov E.F. Handbook of electrical networks. T1-11. Moscow: Energoatomizdat, 2003  8. Rules for the technical operation of power plants and networks. Moscow: Energoatomizdat 1989  9. Sokolov S.E. Operation and repair of generators and distribution devices of electric stations. Almaty, AIPET, 2005  10. Sokolov S.E. Operation and repair of overhead and cable lines Almaty, AIPET, 2006  11. Barkan Ya.D. Operation of electrical systems. Tutorial. Moscow: Higher school, 1990  12. Nemirovskiy A.E., Sergievskaya I.Yu., Krepysheva L.Yu. Electrical equipment of electrical networks, stations and substations: textbook. allowance. Moscow: Infra-Engineering, 2020. |

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| **Module name** | **MEE -В49 Design of electrical networks and systems** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate professor Genbach Natalya Alekseevna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrical networks and systems/Transmission of electrical energy |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of bachelor's knowledge in the field of theory of calculations and analysis of the modes of electrical networks and systems and their design using software and computer systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - classification and schematic diagrams of electrical networks;  - requirements for electrical network diagrams;  - schemes for power distribution and connection to the power plant network;  - schemes of connection to the network of step-down substations;  - principles of drawing up options for the configuration of the electrical network;  - main technical and economic indicators;  - ways to increase the capacity of supply and distribution electrical networks.  **are able**:  - develop the principles of organization, design of the electrical network;  - use application software packages for calculations, modeling and automation of the design of electrical networks;  - to formulate the main technical and economic requirements for the designed devices and systems;  - choose the parameters and schemes of electrical networks.  **COMPETENCES**: can choose the parameters and schemes of electrical networks when designing an electrical network, carry out technical and economic calculations using application programs, analyze reference and regulatory literature, draw up technical documentation. |
| **Content** | Formation of knowledge on the design of electrical networks and systems. Development and visualization of the structure of the electrical network. The main characteristics of the components of electrical networks and systems and the features of their placement on the ground. Feasibility study of development options. Calculation of steady state modes and optimization of the mode by reactive power and voltage using RastrWin and PSCAD programs. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Евдокунин Г.А. Электрические системы и сети: Учебное пособие для электроэнергетических спец. вузов. – СПб: Издательство Сизова М.П., 2012.  2 Герасименко А.А. Передача и распределение электроэнергии: Учеб.пособие. – Ростов-на Дону: Феникс, 2014.  3. Проектирование электрических сетей: учеб. пособие / С.С. Ананичева, Е.Н. Котова. — Екатеринбург: Изд-во Урал. ун-та, 2017. — 164 с  4. Оржанова Ж.К., Тергеусизова М.А. Проектирование электрических сетей и систем. Конспект лекций для студентов специальности 5В071800 – Электроэнергетика. Алматы: АУЭС, 2015.  5.Оржанова Ж.К., Утешкалиева Л.Ш. Электрические сети и системы. Сборник задач к практическим занятиям для студентов специальности 5В071800 – Электроэнергетика. – АУЭС: Алматы, 2017.  6. Оржанова Ж.К., Генбач Н.А. Проектирование электрических сетей и систем. Методические указания к выполнению курсового проекта для студентов специальности 5В071800 – Электроэнергетика. Алматы: АУЭС, 2017.  7. Азаров В.С. Передача и распределение электроэнергии в примерах и решениях. Учебное пособие. - Москва: МГОУ, 2005.  8. Соколов С.Е., Сажин В.Н., Генбач Н.А. Электрические сети и системы. Учебное пособие. - АУЭС, 2010.  9. Лыкин, А.В. Электрические системы и сети: учеб. пособие/ А. В. Лыкин- М.: Университетская книга, 2008.  10. Правила технической эксплуатации электрических станций и сетей. РД 34 РК.20.501-02. – 2015. |

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| **Module name** | **MEE -В50 Calculations of modes in electrical networks** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Bektemirov Anur Talgatovich |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrical networks and systems/Transmission of electrical energy |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge among bachelors in the field of emergency operation modes of electric power systems, calculations of modes and methods for regulating the operation modes of electrical networks and systems of high and extra high voltage.  **LEARNING OUTCOMES:**  **Bachelors know**:  - basic equations and methods for setting the initial data;  - algorithms for calculating the mode parameters at the ends of the line. Calculations of modes of the greatest and least loads;  - modes of one-sided connection of the line without compensating devices and remove;  - methods for calculating the operating modes of high and extra high voltage power transmission;  - methods of voltage regulation in electrical networks.  **are able**:  - draw up equivalent circuits and determine their parameters for power transmission of various voltages;  - calculate the modes of operation of electrical networks of various voltages;  - analyze the modes of operation of networks and manage them;  - to determine and increase the capacity of power lines.  **COMPETENCES**:  - the ability to analyze normal, emergency and post-emergency modes of operation of electrical networks of high and extra high voltage;  - independently perform calculations of modes of electrical networks of varying complexity;  - manage the operating modes of electrical networks and increase them  economy and reliability. |
| **Content** | Mastering knowledge in the field of the theory of calculations and analysis of the modes of electrical networks and systems, methods of their calculation and optimization. The study of the technology for calculating electrical modes, methods for setting the initial data, the algorithm for calculating various modes of electrical systems. Formation of calculation models, calculation and analysis of prospective, current and emergency modes in electric power systems. Application of RastrWin, PSCAD and RTDS programs in calculations of modes of electrical networks and systems. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Евдокунин Г.А. Электрические системы и сети: Учебное пособие для  электроэнергетических спец. вузов. – СПб: Издательство Сизова М.П., 2016.  2 Герасименко А.А. Передача и распределение электроэнергии: Учеб.  пособие. – Ростов-на Дону: Феникс, 2011.  3. Фурсанов М.И. Определение и анализ потерь электроэнергии в  электрических сетях энергосистем. – Мн.: УВНЦ при УП  “Белэнергосбережение”, 2005. – 207 с.  4. Справочник по проектированию электрических сетей / Под ред. Д.А.  Файбисовича. - М.: Издательство НЦ ЭНАС, 2005. – 352 с.  5. Рыжов Ю.П. Дальние электропередачи сверхвысокого напряжения:  учебник для вузов- М.: Издательский дом МЭИ, 2007.-488с  6. Хрущев Ю.В. Методы расчета устойчивости энергосистем.  https://drive.google.com/file/d/1v3RZsX9qXHMv5FvHbNH5JijrAxMH5aFz/view?usp=sharing  7. Жданов П.С. Вопросы устойчивости электрических систем.  https://drive.google.com/file/d/1sqs3bwUNfrYroK8WuD\_q5s3\_NZDlNpI/view?usp=sharing  8. Kundur P. Power System Stability and Control  https://drive.google.com/file/d/1t3v8rPV6bZ6lermR2KiQy0N9gXJJzVa1/view?usp=sharing |

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| **Module name** | **MEE - В51 Transition processes in electrical engineering** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | PhD Berdimurat Ainur Dastanovna |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  **Specialisation** |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Electrotechnical materials science/ Electrotechnical materials and products |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of students' knowledge on the issues of static and dynamic stability of electric power systems in case of violation of their operation mode.  **LEARNING OUTCOMES:**  **Bachelors know**:  - modes of operation of electrical networks and systems;  - types and methods of calculation of short circuit currents;  - features of transient processes in the electric power industry;  - conditions for the stability of electric power systems.  **are able**:  - draw up equivalent circuits for elements of electrical networks and systems;  - simulate electrical systems using the RastrWin software package;  - make calculations of currents and voltages in electrical networks in steady state and transient modes.  **COMPETENCES**:  - freely navigate the methods of studying transient processes, static and dynamic stability of power systems;  - have the skills of practical calculation of short circuit currents and analysis of transient processes for power systems;  - evaluate the stability margin of the energy system;  - apply the method of symmetrical components to the study of transients. |
| **Content** | General information about transient processes Basic concepts, terms and definitions of sustainability. General concepts and definitions of short circuits. Three-phase short circuit. Equivalent circuits and vector  diagrams Calculation of three-phase short-circuit currents. Method of symmetrical components. Asymmetrical short circuits. Features of asymmetric short circuits. Methods for calculating asymmetric short circuits. Asymmetric short circuits (two-phase short circuits). Calculation of a two-phase short circuit. Compilation of replacement schemes. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Куликов Ю.А. Переходные процессы в электроэнергетических системах М.: «Омега-Л» 2013  2. Переходные процессы в электроэнергетических системах /под редакцией Крючкова И.П., и др./ М.: МЭИ 2009  3. Абдурахманов А.А., Мукашева-Рамазанова Т.У. Переходные процессы в электроэнергетике (Методические указания и задания к РГР-№1) Алматы, АУЭС 2013  4. Тохтибакиев К.К., Абдурахманов А.А., Тананова А. Электромагнитные и электромеханические переходные процессы. (МУ и задания к выполнению лабораторных работ №1и2) Алматы, АУЭС 2015  5. Умбеткулов Е.К., Абдурахманов А.А., Тананова А. . Электромагнитные и электромеханические переходные процессы.. (МУ и задания к РГР-№2,3). Алматы, АУЭС 2014  6. Тохтибакиев К.К.,Сажин В.Н. Электромагнитные и электромеханические переходные процессы. Методические указания и задания к выполнению расчетно-графических работ для студентов специальности 050718 – Электроэнергетика. Алматы: АИЭС, 2009.  7. Тохтибакиев К.К., Лавронов К.А. Электромагнитные и электромеханические переходные процессы. Методические указания к выполнению лабораторных работ для студентов специальности 050718 – Электроэнергетика. Алматы: АИЭС, 2007 |

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| **Module name** | **MEE -В52 Energy-saving technologies at industrial facilities and infrastructure** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate Professor, Cand.Tech.Sc Kalieva Kazima Zhanbyrbaevna (Kazakh)  Senior Lecturer Utkin Leonid Petrovich (Russian) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15, Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Electric power supply, Alternative energy and energy saving technologies |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of students' systematic knowledge in the field of energy saving in electric power systems, the formation of skills in the application of standard measures, modern technologies and solutions to improve the energy efficiency of electric power systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - organizational, legal, technical, economic mechanisms of energy saving;  - methods for assessing the efficiency of energy use in energy complexes;  - methods for evaluating the effectiveness of the implementation of measures to improve the energy efficiency of power supply systems;  -methods and means of reducing energy losses;  **are able**:  - evaluate the efficiency of energy carriers use in energy complexes;  - draw up energy balances;  - analyze the energy passport of the organization and the energy declaration of the organization;  - develop and implement energy-saving technologies;  - evaluate the effectiveness of the implementation of energy-saving measures.  **COMPETENCES**: determining the potential for energy saving, issuing an energy passport, developing technologies and developing measures to save energy and improve the energy efficiency of electric power systems. |
| **Content** | The legislative and regulatory framework for energy saving is given, practical ways of implementing energy-saving policy at industrial enterprises, housing and communal services (HCS), transport, and agriculture are described, and economic aspects are disclosed. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Фрейдкина Е. М. Оценка эффективности энергосберегающих мероприятий. Высшая школа технологии и энергетики СПбГУПТД, 2018. - 81с.  2. Казанина И.В. Энергосбережение. Учебное пособие. АУЭС. Алматы, 2011. -80 с.  3. Энергосбережение на предприятиях промышленности и железнодорожного транспорта [Текст]: учебное пособие / В.М. Лебедев [и др.]; Под ред. В.М. Лебедева. - М.: ФГБУ ДПО "Учебно-методический центр по образованию на железнодорожном транспорте", 2017. - 116 с.- (Высшее образование).  4.Воротницкий, В. Э. Энергосбережение и повышение энергетической эффективности в электрических сетях. Справочно-методическое пособие [Текст] / В. Э. Воротницкий. - М.: Теплоэнергетика, 2017. - 330 с. |

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| **Module name** | **MEE -В53 Lighting technology and illumination** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Professor, Cand.Tech.Sc Tergemes Kazhybek Tleugaliuly (Kazakh)  Senior lecturer Zhivaeva Olga Petrovna (Russian) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15, Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Physics 2,  Electrotechnical materials science,  Electric power supply. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to train a specialist capable of performing the entire list of tasks related to the design and operation of lighting installations for indoor and outdoor lighting, entertainment and sports facilities.  **LEARNING OUTCOMES:**  **Bachelors know**:  - main types of light sources and their characteristics;  - design features and physical foundations of the operation of lighting products.  **are able**: make calculations of lighting installations for indoor and outdoor lighting.  **COMPETENCES**: apply normative documents in practice, be guided by them when solving technical issues of production. |
| **Content** | The discipline introduces undergraduates to the basics of legal metrology, the basics of technical regulation, the State system for ensuring the uniformity of measurements; as well as with international recommendations for estimating the uncertainty of measurement results, methods for calculating measurement uncertainty and their application in the calibration of measuring instruments. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Казанина И.В., Живаева О.П. Светотехника и источники света: Учебное пособие. Алматы: АУЭС, 2019. – 95 с.  2. СНиП РК 2.04-05-2014. Естественное и искусственное освещение / Гос.нормативы в области архитектуры, градостроительства и строительства; Строительные нормы и правила РК. - Астана, 2014.  3. Козловская В.Б. Электрические освещение. – Мн.: «Техноперспектива», 2011.  4. Шеховцов В.П. Осветительные установки промышленных и гражданских объектов. – М.: «Форум», 2009.  5. Справочная книга по светотехнике / Под ред. Ю.Б. Айзенберга – 3-е изд., перераб. и доп. – М.: Энергоатомиздат, 2008.  6. Шеховцов В.П. Электрическое и электромеханическое оборудование. – М.: «ФОРУМ-ИНФРА-М», 2008. |

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| **Module name** | **MEE -В54 Design of electric power supply systems** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Zhivaeva Olga Petrovna (Russian)  Associate Professor Manapova Gulnar Dzhambulovna (Kazakh) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30, SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Electrotechnical materials science,  Electrical devices and measuring technology,  Electric power supply. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  study of the principles of designing power supply systems at various stages of electrical loads of industrial enterprises, the features of power supply of specific electrical receivers, as well as the neutral modes of electrical installations that satisfy reliable and safe operation.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the basic requirements applicable to power supply systems;  - the main issues of rational power supply of enterprises;  - stages of design.  **are able**:  - to design the power supply system of industrial enterprises;  - to make technical and economic calculations in power supply systems;  - calculate short-circuit currents and select equipment in a network with a voltage above 1000 V.  **COMPETENCES**:  - construction of schemes of internal and external power supply;  - work with documentation in the design of power supply systems of objects. |
| **Content** | The discipline studies the requirements for power supply systems; principles of designing power supply systems at various stages of electrical loads of industrial enterprises; power supply of lighting installations; selection of the number, power and location of shop transformers; external and internal power supply schemes; technical and economic calculations in power supply systems of industrial enterprises; arrangement of open and closed switchgears; features of power supply of specific power receivers; lightning protection of buildings and structures. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Киреева Э.А. Электроснабжение и электрооборудование организаций и учреждений. – М.: «КНОРУС», 2015.  2. Гужов Н.П. Системы электроснабжения. – Новосибирск : НГТУ, 2015.  3. Маньков В.Д. Основы проектирование систем электроснабжения. – СПб.: НОУ ДПО «УМИТЦ ЭлектроСервис», 2010.  4. Шеховцов В.П. Расчет и проектирование схем электроснабжения. – М.: «Форум-Инфра-М», 2010.  5. Ополева Г.Н. Схемы и подстанции электроснабжения. – М.: «ИД ФОРУМ-ИНФРА-М», 2010.  6. Щербаков Е.Ф. Электроснабжение и электропотребление на предприятиях. – М.: «Форум», 2010.  7. Сивков А. А., Основы электроснабжения : учеб. пособие / А.А. Сивков, А.С. Сайгаш, Д.Ю. Герасимов; Томский политехнический ин-т. - 2-е изд., испр. и доп. - М. : Юрайт, 2020. - 174 с. - (Высшее образование; НИТПУ)1. 2. |

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| **Module name** | **MEE -В55 Installation, commissioning and operation of electrical equipment** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Associate Professor Dmitrichenko Viktor Ivanovich (Russian)  Senior lecturer Amangaliyev Yerlan Zingaleevich (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Electrical devices and measuring technology / Switching devices and measurement of electrical quantities |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to acquaint students with the methods and technology for the production of electrical work, adjustment, operation and repair of electrical equipment and electrical installations of industrial enterprises.  **LEARNING OUTCOMES:**  **Bachelors know**:  - basic techniques for conducting the installation of wires and cables with various laying methods;  - methods for conducting preventive tests of cables, motors and transformers;  - measures for the correct and optimal operation of electrical equipment;  **are able**:  - draw up technological maps for installation;  - develop regulations for the production of electrical installation and adjustment work;  - develop measures for the operation of electrical equipment.  **COMPETENCES**:  - basic techniques for conducting the installation of wires and cables with various laying methods;  - methods for conducting preventive tests of cables, motors and transformers;  - measures for the correct and optimal operation of electrical equipment;  - apply in practice regulatory documents, be guided by them when solving technical issues of production. |
| **Content** | The basics are given for the organization and conduct of electrical work, the methods and stages of the installation of electrical equipment, acceptance documentation are studied, the skills of applying the acquired knowledge to solve specific engineering and technical problems are given. Familiarization of students with the organization and methods of installation and repair of electrical equipment of power stations and substations, the technology of installation and repair of cable and overhead lines |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1.Дмитриченко В. И., Казанина И.В. Монтаж, наладка и эксплуатация электрооборудования: методические указания к выполнению лабораторных работ для студентов специальности 5В071800 - Электроэнергетика. – Алматы, АУЭС, 2019.-29с.  2. Дмитриченко В.И., Желдикбаева А. Монтаж, наладка и эксплуатация электрооборудования: Методические указания и задания к выполнению расчетно-графических работ 1,2,3 для студентов специальности 5В071800 Электроэнергетика. – Алматы, АУЭС, 2017. – 36 с.  3.Сибикин Ю.Д. Техническое обслуживание, ремонт электрооборудования и сетей промышленных предприятий. Кн.1 - М.: Академия, 2012. - 208с.  4.Грунтович Н.В., Монтаж, наладка и эксплуатация электрооборудования : учеб. пособие / Н.В. Грунтович. - Минск : Новое знание, 2019; М.: ИНФРА-М, 2019. - 271 с. - (Высшее образование: Бакалавриат)  5. <https://aues.kz/facultet/eef/kaf_epp/78/umm/epp_1.pdf>  6. <http://mexalib.com/view/23384>  7. https://bookmix.ru/book.phtml?id=989055 |

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| **Module name** | **MEE -В56 Relay protection of electric power systems** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Agimov Talgat Nurlanovich (Kazakh)  Associate Professor Bashkirov Mikhail Vladimirovich (Russian) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and communication technology,  Theoretical basis of electrical engineering,  Fundamentals of relay protection in electric power systems/Element base of relay protection. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the knowledge of the basics of relay protection technology. Methods for calculating the settings of the elements of the electric power system. The principles of operation and schemes of relay protection of lines, transformers and autotransformers 110-220kV on a traditional and microprocessor base, the principle of operation and schemes of relay protection of tires and redundancy devices in case of breaker failure are studied..  **LEARNING OUTCOMES:**  **Bachelors know**:  - the principle of operation and schemes of relay protection of lines 110-220kV;  - the principle of operation and schemes of relay protection of power transformers and autotransformers.  **are able**:  - work with relay protection circuits for 10-35kV, 110-220kV lines;  - to calculate the settings of the main and backup protections;  - to make adjustment of schemes of relay protection..  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - analyze and critically evaluate the design advantages and disadvantages of various relay protection and automation devices offered for operation by various manufacturers.. |
| **Content** | The discipline introduces undergraduates to the basics of legal metrology, the basics of technical regulation, the State system for ensuring the uniformity of measurements; as well as with international recommendations for estimating the uncertainty of measurement results, methods for calculating measurement uncertainty and their application in the calibration of measuring instruments. |
| **Current control** | Coursework -1, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Агафонов А.И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А.И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл.  2. Дьяков А. Ф., Платонов В. В. Основы проектирования релейной защиты электроэнергетических систем: Учебное пособие. - М.: Издательство МЭИ, 2010.- 248с., ил.  3. Булычев А. В., Наволочный А.А. Релейная защита в распределительных электрических сетях.: пособие для практических расчетов/А. В. Булычев, А.А., Наволочный. -М.: ЭНАС, 2011. -208с..: ил.  5. М. В. Башкиров, К. М. Асанова. Релейная защита электроэнергетических систем. Конспект лекций для студентов, обучающихся по образовательной программе 6В07101 – «Электроэнергетика». – Алматы: АУЭС, 2021. – 186 с.  6. https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti\_11.html  7. https://pro-rza.ru/ |

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| **Module name** | **MEE -В57 Microprocessor relays and modern high voltage electrical network protection systems** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Arystanov Nuri Nigmettulaevich (Kazakh)  Associate Professor Bashkirov Mikhail Vladimirovich. (Russian) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15, Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and communication technology;  Theoretical basis of electrical engineering;  Fundamentals of relay protection in electric power systems/Element base of relay protection |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  training of a highly qualified specialist capable of solving the entire range of tasks related to the calculation, selection and operation of relay protection devices for various elements of high voltage electrical networks. Calculate the operation parameters of microprocessor-based relay protection systems, configure the relay in accordance with the selected settings.  **LEARNING OUTCOMES:**  **Bachelors know**:  - scope of various types of relay protection;  - principle of operation of digital relay protection terminals;  **are able**:  - to calculate the settings of the main and backup protections;  - make parameterization of digital terminals;  - read relay protection diagrams and secondary circuit diagrams, troubleshoot the electrical part.  **COMPETENCES**:  - apply in practice regulatory documents, be guided by them when solving technical issues of production;  - determine possible options for the implementation of relay protection and automation of a power facility  - participate in the installation, adjustment and maintenance of microprocessor devices for relay protection of automation. |
| **Content** | The study of the principles of operation of modern longitudinal-differential, remote and differential-phase high-frequency protection of power lines 110-220kV.  Pre-processing of analog input signals. Digital-to-analog and analog-to-digital converters. Calculation of the operation parameters of microprocessor relay protection systems, relay setting in accordance with the selected settings. Acquisition of practical skills in working with relay protection terminals of the world's leading companies SIEMENS, ABB, Schneider Electric, SEL, RZASystems. Work at the stand "Digital substation" |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Агафонов А. И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А. И. Агафонов, Т. Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл.  2. Дьяков А.Ф. Микропроцессорная автоматика и релейная защита электроэнергетических электроэнергетических систем.: Учеб. пособие / А.Ф. Дьяков, Н.И. Овчаренко. – 2-е изд., стер. – М.: Изд. дом МЭИ, 2010. – 336 с., ил.  3. Беляев А. В., Рояк М.Ш. Автоматизированные системы управления элетроснабжением на базе цифровых терминалов РЗА. – М.: НТФ «Энергопрогресс», 2015. – 108 с. Библиотечка электротехника. Вып.11 (203).  4. Дьяков А. Ф., Платонов В. В. Основы проектирования релейной защиты электроэнергетических систем: Учебное пособие. - М.: Издательство МЭИ, 2010.- 248с., ил.  5. Булычев А. В., Наволочный А.А. Релейная защита в распределительных электрических сетях.: пособие для практических расчетов/А. В. Булычев, А.А., Наволочный. -М.: ЭНАС, 2011. -208с..: ил.  6. М. В. Башкиров, К. М. Асанова. Релейная защита электроэнергетических систем. Конспект лекций для студентов, обучающихся по образовательной программе 6В07101 – «Электроэнергетика». – Алматы: АУЭС, 2021. – 186 с.  7. https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti\_11.html  8. https://pro-rza.ru/ |

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| **Module name** | **MEE -В58 Design of relay protection of electrical networks** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Zhagyparov Yerkebulan Nurlanovich (Kazakh)  Senior lecturer Utkin Leonid Anatolievich. (Russian) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  **specialisation** |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and communication technology,  Theoretical basis of electrical engineering,  Fundamentals of relay protection in electric power systems/Element base of relay protection. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge in the field of relay protection design. Mastering the principles of relay protection design, the specifics of calculations of relay protections of various types, the use of application programs for calculations and drawings.  **LEARNING OUTCOMES:**  **Bachelors know**: - the main provisions of the unified system of design documentation;  -programs for calculating currents and voltages in case of damage;  - programs for calculating relay protection;  -basic protection circuits for transformers, generators, buses.  **are able**:  - apply complex schemes for calculating short circuits and open-phase modes;  - to calculate the protection of transformers, generators, tires; -use computer programs for the calculation and graphic design of relay protection and automation projects.  **COMPETENCES**: the ability to apply standard methods of calculation and automation of relay protection design; take part in the selection and design of elements, systems and objects of the electric power industry and electrical engineering in accordance with the technical specifications. |
| **Content** | During the design of relay protection, such issues are considered as: calculation of relay protection settings; calculation of asymmetric short circuits and open-phase modes. Knowledge of automated relay protection calculation programs. Selection of relay protection devices and auxiliary equipment, as well as connection and switching schemes; execution of drawings of operational direct current circuits of SOTS; drawing up specifications for projects. All calculations and drawings are performed using computer-aided design systems on a PC. Application of PSCAD programs. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Агафонов А.И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А.И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл.  2. Дьяков А. Ф., Платонов В. В. Основы проектирования релейной защиты электроэнергетических систем: Учебное пособие. - М.: Издательство МЭИ, 2010.- 248с., ил.  3. Булычев А. В., Наволочный А.А. Релейная защита в распределительных электрических сетях.: пособие для практических расчетов/А. В. Булычев, А.А., Наволочный. -М.: ЭНАС, 2011. -208с..: ил.  5. М. В. Башкиров, К. М. Асанова. Релейная защита электроэнергетических систем. Конспект лекций для студентов, обучающихся по образовательной программе 6В07101 – «Электроэнергетика». – Алматы: АУЭС, 2021. – 186 с.  6. https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti\_11.html  7. https://pro-rza.ru/ |

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| **Module name** | **MEE -В59 Theoretical foundations of electrical installations of non-traditional and renewable energy** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Soltanayev A.M. (Kazakh, Russian, English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2, Use of renewable energy sources/Alternative energy and energy saving technologies |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  prepare a specialist capable of performing the entire list of tasks related to the study of the technology of converting energy from inexhaustible, renewable energy sources into electrical energy.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main technical schemes and energy characteristics of modern types of solar power plants;  - solar collectors and - solar photovoltaic installations;  - equipment for converting wind energy;  - equipment for converting the energy potential of small rivers;  - equipment for converting the energy potential of biofuels;  -environmental and socio-ecological characteristics of solar energy;  **are able**:  - to calculate the energy potential from renewable energy sources;  - make the necessary calculations for the design of power supply from renewable energy sources;  - evaluate all categories of renewable energy resources.  **COMPETENCES**:  - have an idea about renewable energy sources, prospects for various types of renewable energy, their classification  - know the circuit solutions of solar power and heat supply systems, wind and hydropower installations |
| **Content** | The technologies and market of wind generation are being studied. Types and principle of operation of wind turbines. Complete set of wind power plants. Types of generators. Electromechanical converters in wind power plants with synchronous generators with electromagnetic excitation and with permanent magnets, asynchronous machines. Energy storage. Energy storage. Operating modes. Methods of accumulation depending on the type of energy. Inventory. Characteristics. Technologies and market of solar generation. Generation based on solar photovoltaic systems. Systems for optimizing the operating modes of photovoltaic converters. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1.Мукажанов В. Н. Возобновляемые источники энергии. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  2.Казанина И.В. Энергосбережение. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  3. Сырлыбаев Р.С. Казанина И.В. Нетрадиционные источники энергии. Учебное пособие. АУЭС. Алматы, 2011.-80 с.  4.Burton Tony. Wind power — Handbooks, by John Wiley & Sons, Ltd Baffins Lane, Chichester West Sussex, PO19 1UD, England. 2011. – 609 р.  5.Сибикин Ю.Д., Сибикин М.Ю. Альтернативные источники энергии.М.: ИП РадиоСофт, 2014.-248 с.  6.Умбетов Е.С., Живаева О.П. Основы использования возобновляемых источников энергии и энергосбережение. Методические указания и задания к выполнению расчетно - графических работ № 1,2. -Алматы, АУЭС, 2013.- 12с.  7.Қойшиев Т. Қ. Жаңғыртылатын энергия көздері: Оқулық.Алматы:2013.-256 б. |

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| **Module name** | **MEE -В60 Complex assessment of renewable energy resources** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Senior lecturer, PhD Rasmukhametova A.N. (Kazakh)  Associate professor Kazanina I.V. (Russian)  Senior lecturer Soltanayev A.M. (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics, Theoretical basis of electrical engineering 2, Use of renewable energy sources/Alternative energy and energy saving technologies |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to prepare a specialist capable of performing the entire list of tasks related to mastering the knowledge of assessing the potential of renewable energy sources using modern computer technology.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the principle of operation and technical characteristics of modern measuring equipment used to assess the potential of renewable sources;  - modern methods of forecasting renewable energy sources;  **are able**: - carry out survey work to assess the climatic characteristics of renewable resources for the most rational placement and design of power plants;  - process and analyze statistical data for the forecast of renewable energy resources;  **COMPETENCES**: be able to determine the energy potential of wind, solar and hydrological resources, calculate the parameters of the main components and the characteristics of the generation of wind and solar electricity. |
| **Content** | The order and methods of using data from observations of wind speed at meteorological stations are being studied. Using information about local winds when placing autonomous wind turbines. Methods for assessing the performance of wind power plants with known characteristics of the wind regime. solar radiation. Basic concepts and definitions. Information support for solar energy calculations. Measuring systems for monitoring wind energy. Methods for calculating solar energy resources. Measuring systems for monitoring solar radiation. Feasibility study for the use of renewable energy sources. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Возобновляемые источники энергии и энергосбережение: Путеводитель по современным технологиям / под ред. Н. Искакова. - Астана, 2008.- 353с.  2.Дукенбаев К., Возобновляемая Энергия. Основы; потенциал;технология: Использование .-А.: «SignetPrint», 2014.  3.Матвеев В., Возобновляемые источники энергии. Энергия-солнца, биомассы, ветра, воды. Энергетические технологии и установки.-А.: «Бастау», 2009.  4.Куашнинг Ф., Системы возобновляемых источников энергии. Технология – Расчеты - Моделирование: пер. с немецкого. Астана: Foliant, 2013.  5.Болотов А.В., Нетрадиционные и возобновляемые источники электроэнергии. Учебное пособие. А.: «АУЭС», 2011.  6.Кашкаров А.П., Ветрогенераторы, солнечные батареи и другие полезные конструкции. М.: «ДМК Пресс», 2011.  7.Мукажанов В.Н., Возобновляемые источники энергии. Учебное пособие. А.: «АУЭС», 2011.  8.Джумамухамбетов Н.Г., Нетрадиционные возобновляемые источники энергии. А.: «Эверо», 2010.  9.Методы расчета ресурсов возобновляемых источников энергии. под ред. Виссарионов В.И. М.: «МЭИ», 2009  10.Бушуев В. В., Энергетика -2050. М.: «ИД Энергия», 2007. |

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| **Module name** | **MEE - В61 Designing of small power supply systems using RES** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Zhunusova G.S. (Kazakh)  Associate professor Kazanina I.V. (Russian)  Senior lecturer Soltanayev A.M. (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theoretical basis of electrical engineering 2; Use of renewable energy sources/Alternative energy and energy saving technologies; Electric power supply |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of knowledge about the features of the technological process of energy conversion, both individual elements of the power supply system, and the whole complex of power supply issues using non-traditional and renewable energy sources to supply consumers.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the basic requirements applicable to power supply systems;  - the main issues of rational power supply of enterprises;  - design stages;  - power supply circuits of workshop substations;  - classification of power supply networks;  - ways of laying cables, wires and conductors with a voltage above 1 kV across the territory of the enterprise;  - conditions for choosing electrical equipment with voltages above 1000 V.  **are able**:  - analyze the content of the object;  - basic requirements applied in power supply systems of remote consumers;  - the main issues of efficient power supply of enterprises;  design stages;  - power supply from own power plants;  - classification of power supply networks.  **COMPETENCES**: operating rules and methods for inspecting electrical installations according to the rules for the installation of electrical installations; Choosing the optimal solution when planning work. |
| **Content** | Design of power supply systems, components of the project. Design stages. Working documentation. Computer-aided design systems for power supply facilities. Selection, switching and protective electrical equipment of electrical substations and switchgears. Optimization and examples of evaluating the economic efficiency of the implementation of projects for renewable energy installations and energy saving projects. Construction organization project and work execution project. Work organization technology. |
| **Current control** | Coursework -1, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | 1. Гужов Н.П. Системы электроснабжения. – Новосибирск : НГТУ, 2015.  2. Манапова Г.Д., Т.С. Малдыбаева. Электроснабжение предприятий. - Алматы: Триумф "Т", 2013.- 432с.  3. Кудрин Б.И. Системы электроснабжения. – М.: «Академия», 2011.  4. Маньков В.Д. Основы проектирование систем электроснабжения. – СПб.: НОУ ДПО «УМИТЦ ЭлектроСервис», 2010.  5. Шеховцов В.П. Расчет и проектирование схем электроснабжения. – М.: «Форум-Инфра-М», 2010.  6. Ополева Г.Н. Схемы и подстанции электроснабжения. – М.: «ИД ФОРУМ-ИНФРА-М», 2010.  7. Манапова Г.Д., Живаева О.П. Проектирование систем электроснабжения удаленных потребителей. Конспект лекций для студентов всех форм обучения специальности 5В071800 – Электроэнергетика. – Алматы: АУЭС, 2010. – 66 с.  7. О.П. Живаева. Проектирование систем электроснабжения удаленных потребителей. Методические указания и задания к выполнению курсовой работы для студентов всех форм обучения специальности 5В071800 - Электроэнергетика - Алматы: АУЭС, 2017.-74 с.  9. Манапова Г.Д., Живаева О.П. Проектирование систем электроснабжения. Конспект лекций для студентов всех форм обучения специальности 5В071800 – Электроэнергетика. – Алматы: АУЭС, 2010.  10. Правила устройства электроустановок Республики Казахстан. – Алматы, 2008. |

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| **Module name** | **MEE -В62 Elements of an automated electric drive** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior Lecturer Kuzmin Yury Vladimirovich (Russian)  Senior Lecturer Darkembayeva Elmira Baizhumaevna (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theory of automatic control /Automatic control systems, Electrical machines, Electric drive / Electromechanical energy converters |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the knowledge of the properties and characteristics of automated electric drive systems, methods for calculating parameters, static and dynamic characteristics of the electric drive, selecting its elements.  **LEARNING OUTCOMES:**  **Bachelors know**:  -ability to work with scientific and technical technical and patent literature;  - the ability to apply basic scientific and theoretical knowledge to solve theoretical and practical problems;  - possession of systems and comparative analysis research skills;  - possession of an interdisciplinary approach to solving problems;  - proficiency in working with a computer and other technical devices;  - the ability to determine energy technical and economic indicators of design solutions;  **are able**:  -to calculate and select the technical means of the information-measuring subsystem of an industrial industrial electric drive;  - describe the relationship between the input and output values ​​of the element, draw up its functional and block diagram.  - Calculate the static dynamic characteristics of elements, own methods for calculating the static and dynamic characteristics of elements of an automated electric drive of the operating modes of electromechanical mechanical electric drive systems..  **COMPETENCES**:  - device and principle of operation of power control elements of an automated electric drive;  - device operating principle of power control elements of an automated electric drive;  - main types of sensors and schemes of connection to the control system;  - mathematical description of the elements of the form of equations and transition functions. |
| **Content** | The subject of study is the main elements of the power and information channels of a modern automated electric drive, taking into account the functional principles of constructing its elements. The principles of construction and characteristics of analog and digital microprocessor devices of the information channel of the electric drive, which are represented by elements of information, comparison, distribution, amplification, calculation, memory, logic, execution, auxiliary, etc., are considered. etc. Research is carried out in the MATLAB Simulink software package. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Москаленко, В.В. Системы автоматизированного управления электропривода [Текст]: учебник / В.В. Москаленко.- М.: ИНФРА-М, 2011.- 208с.  2. Лезнов Б.С. Частотно-регулируемый электропривод насосных установок. М.:»Машиностроение», 2013.-176с.  3. Мустафин М.А., Алмуратова Н.К. Электропривод. Методические указания к выполнению курсовой работы.- Алматы: АУЭС, 2017.-34с.  4. П.И.Сагитов, Р.М.Шидерова, Н.К.Алмуратова Электропривод. Методические указания к выполнению лабораторных работ для студентов специальности «Электроэнергетика».-Алматы: - АУЭС, 2014-34с.  5. Копылов И.П. Электрические машины.-М.: Энергоатомиздат, 2000.  6. Ковчин С.А., Сабинин Ю.А. Теория электропривода.- СПб.: Энергоатомиздат. Санкт – Петербургское отд. 2006.- 496 с.  7. <https://drives.ru/novosti/leznov/>  8. <https://portal.tpu.ru/SHARED/a/ACH/students/Tab1/Electrical_drive.pdf> |

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| **Module name** | **MEE -В63 Electric drive of industrial mechanisms** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior lecturer Yury Vladimirovich Kuzmin (Russian)  PhD, Associate Professor Almuratova Nurgul Kanaevna (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theory of automatic control /Automatic control systems, Electrical machines, Electric drive / Electromechanical energy converters |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the principles of construction and methods of implementing electric drive control systems for specific technological mechanisms that provide the required laws of changing the coordinates of the electric drive.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the principle of operation and design features of typical industrial mechanisms;  - physical phenomena occurring in controlled electric drives of various industrial mechanisms;  - the main characteristics of electric drives of mechanisms of continuous and cyclic action;  **are able**:  - choose ways to control the coordinates of the electric drive of specific mechanisms, depending on belonging to groups of mechanisms;  - evaluate the efficiency of use and choose the type of adjustable electric drive for a particular type of mechanism.  **COMPETENCES**:  - analyze the processes of control and regulation of technological processes by means of an automated electric drive;  - make a preliminary calculation of the parameters and the choice of the main elements of the electric drive for various mechanisms of continuous and cyclic action. |
| **Content** | The general questions of the electric drive and automation of the operating modes of typical general industrial mechanisms of continuous and cyclic action are outlined. General provisions are supplemented by an analysis of specific examples of electric drive circuits for mechanisms of various machines, mechanisms and technological complexes - cranes, hoists, excavators, conveyors, dredgers, etc. Particular attention is paid to the controlled electric drive of pumping and gas compressor units. The study is carried out in the MATLAB Simulink programmable complex. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Учебное пособие. - М.: МГОУ, 2001г. Дисциплина «Автоматизированный электропривод типовых производственных механизмов» 2. Электропривод промышленных механизмов (МУ по выполнению РГР) Алексеев С.Б. Калиева К.Ж. АУЭС 2018. 3. Электропривод М.М. Кацман Москва «Академия» 2014.   4. Электропривод типовых производственных механизмов : учеб. пособие / Ю.Н. Дементьев, В.М. Завьялов, Н.В. Кояин и др.; Томский политехнический ун-т. - М : Юрайт, 2020. - 404 с. - (Высшее образование) |

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| **Module name** | **MEE -В64 Semiconductor converter devices in the electric drive** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior Lecturer Kuzmin Yury Vladimirovich (Russian)  Cand.Tech.Sc, Associate Professor Gali Kakimzhan Oraluly (Kazakh) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes – 15; Laboratory classes - 15; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theory of automatic control /Automatic control systems, Electrical machines, Electric drive / Electromechanical energy converters |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  to teach students to understand the principles of constructing circuits of power converters, their work, to gain skills in calculating and choosing the main elements..  **LEARNING OUTCOMES:**  **Bachelors know**:  - device and principle of operation of modern power semiconductor elements;  - device and principle of operation of semiconductor converters used in the electric drive;  - physical phenomena occurring in semiconductor converters;  - the main parameters characterizing the operation of semiconductor converting devices;  **are able**: - calculate and select the main elements of the circuits of power converting devices;  - make a preliminary calculation of the parameters and selection of a serial converter for a particular application.  **COMPETENCES**:  -analyze reference and normative literature, draw up technical documentation;  - draw up an algorithm and a program for process control.. |
| **Content** | The general questions of the electric drive and automation of the operating modes of typical general industrial mechanisms of continuous and cyclic action are outlined. General provisions are supplemented by an analysis of specific examples of electric drive circuits for mechanisms of various machines, mechanisms and technological complexes - cranes, hoists, excavators, conveyors, dredgers, etc. Particular attention is paid to the controlled electric drive of pumping and gas compressor units. The study is carried out in the MATLAB Simulink programmable complex. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Учебное пособие. - М.: МГОУ, 2001г. Дисциплина «Автоматизированный электропривод типовых производственных механизмов» 2. Электропривод промышленных механизмов (МУ по выполнению РГР) Алексеев С.Б. Калиева К.Ж. АУЭС 2018. 3. Электропривод М.М. Кацман Москва «Академия» 2014. 4. В.Т. Бардачевский, В.В. Буртный, Р.М. Пицан, И.И. Саляк Автоматизированный электропривод (МУ по выполнению лабораторным работам) Львов 2010г. 5. Р.М.Шидерова, К.О.Ғали, А.Н.Бестерекова. Электр машиналары. Электр энергетика мамандығының студенттеріне арналған дәрістер жинағы. Алматы: АЭжБУ, 2017 6. Р.М.Шидерова, К.О.Ғали, М.Б.Жаркымбекова. Трансформаторларды жобалау. Электрэнергетика мамандығының студенттеріне курстық жұмысты орындауға арналған әдістемелік нұсқаулар. Алматы: АЭжБУ, 2019 – 54 б. 7. <https://www.elec.ru/library/info/elektricheskie-mashiny/> 8. <http://en.bookfi.net/book/585659> |

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| **Module name** | **MEE -В65 Information security and digital control systems for electric drives** |
| **Semester(s) in which the module is taught** | 5 |
| **Person responsible for the module** | Professor Tsyba Yuri Alexandrovich (Russian)  Senior lecturer Zhanar Zhumakanovna Toygozhinova (Kazakh) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theory of automatic control /Automatic control systems, Electrical machines, Electric drive / Electromechanical energy converters |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  mastering the principles of construction and methods of implementing electric drive control systems that provide the required laws for changing the coordinates of the electric drive, as well as acquiring skills in designing, calculating and researching such systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - methods for developing generalized options for solving electric drive problems, analyzing options, predicting consequences, finding compromise solutions in conditions of multi-criteria, uncertainty;  - methods for creating and analyzing theoretical models that allow predicting the properties and behavior of objects of an automated electric drive;  - methods for carrying out technical calculations and determining the technical and economic efficiency of developments;  **are able**: -  apply in practice regulatory documents, be guided by them when solving technical issues of production;  - compose digital-to-analogue electric drive control systems;  - to compose analog and digital-to-analogue position control systems for a positional electric drive.  **COMPETENCES**:  - read and draw up control schemes for an automated electric drive;  - carry out preliminary calculation of parameters and selection of the main elements of the electric drive.. |
| **Content** | Motion control systems based on microcontrollers (MC) and digital signal processors are presented, which provide the construction of a flexible and high-performance electric drive control system, the use of intelligent load and motor speed control systems that allow increasing the efficiency of low-power electric drives. The synthesis of automatic control systems for electric drives is carried out, inverse equations for the main components of the generalized synthesis algorithm, the generalized algorithm for the synthesis of nonlinear control systems for electric drives, and the organization of the calculation procedure are considered. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Цыба Ю.А. Системы управления электроприводами: Конспект лекций. – Алматы: АИЭС, 2007.- 50с. 2. Сагитов П.И., Цыба Ю.А. Электрические машины систем автоматики: Учеб­ное пособие. – Алматы: АИЭС, 2004. – 90с. 3. Цыба Ю.А., Тойгожинова Ж.Ж. Электр жетегін басқару жүйелері. Оқу құралы. АЭжБУ.-Алматы, 2013. 4. Бороденко В.А. Практический курс теории линейных систем автоматического регулирования: Учебное пособие. ПГУ – Павлодар, 2007– 200с. 5. Денисов В.А., Электроприводы переменного тока с частотным управлением : учеб. пособие / В.А. Денисов. - Старый Оскол : ТНТ, 2018. - 164 с. 6. Бороденко В.А. Теория автоматического управления. Лабораторный практикум. – Павлодар, Изд-во ПГУ, 2004. – 15с. 7. Лазарев Ю. Моделирование процессов и систем в MATLAB. Учебный курс. – СПб.: Питер, 2005. – 512с. 8. Лурье Б.Я., Энрайт П.Дж. Классические методы автоматического управления. – СПб.: БХВ – Петербург, 2004. – 640с. 9. Сагитов П.И., Цыба Ю.А., Алмуратова Н.К. Электр жетегін басқару жүйелері. Электр энергетикасы мамандығының студенттері үшін зертханалық жұмыстарды орындау бойынша әдістемелік нұсқаулықтар.-Алматы: АЭжБУ, 2015. |

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| **Module name** | **MEE -В66 Diagnostics, operation and commissioning of a modern electric drive** |
| **Semester(s) in which the module is taught** | 7 |
| **Person responsible for the module** | Senior Lecturer Kuzmin Yury Vladimirovich |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Specialisation |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Theory of automatic control /Automatic control systems, Electrical machines, Electric drive / Electromechanical energy converters |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  teaching students how to set up modern automated electric drives, design and operate their diagnostic systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - technical parameters, characteristics and features of various types of electrical machines;  - classification of the main electrical and electromechanical equipment of the industry;  - elements of automation systems, their classification, main characteristics and principles of building automatic control systems for electrical and electromechanical equipment;  - classification and purpose of electric drives, physical processes in electric drives;  - selection of electric motors and control schemes;  - arrangement of power supply systems, selection of elements of the power supply and protection circuit;  - physical principles of operation, design, technical characteristics, areas of application, rules for the operation of electrical and electromechanical equipment;  **are able**:  - determine the electric power parameters of electrical machines and apparatuses, electrical devices and systems;  - select technological equipment for the repair and operation of electrical machines and apparatus, electrical devices and systems, determine the best options for its use;  - organize and carry out adjustment, adjustment and testing of electrical and electromechanical equipment;  - analyze faults in electrical equipment.  **COMPETENCES**:  - performance of works on technical operation, maintenance and repair of electrical and electromechanical equipment;  - use of basic measuring instruments. |
| **Content** | The discipline provides the necessary knowledge related to the process of diagnosing complex electromechanical systems built on the basis of modern semiconductor digitally controlled energy converters, allows you to master the process of troubleshooting and setting up equipment |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Учебное пособие. - М.: МГОУ, 2001г. Дисциплина «Автоматизированный электропривод типовых производственных механизмов» 2. Электропривод промышленных механизмов (МУ по выполнению РГР) Алексеев С.Б. Калиева К.Ж. АУЭС 2018. 3. Электропривод М.М. Кацман Москва «Академия» 2014. 4. В.Т. Бардачевский, В.В. Буртный, Р.М. Пицан, И.И. Автоматизированный электропривод (МУ по выполнению лабораторным работам) Львов 2010г. 5. Денисов В.А., Электроприводы переменного тока с частотным управлением : учеб. пособие / В.А. Денисов. - Старый Оскол : ТНТ, 2018. - 164 с. 6. Бороденко В.А. Теория автоматического управления. Лабораторный практикум. – Павлодар, Изд-во ПГУ, 2004. – 15с. 7. Лазарев Ю. Моделирование процессов и систем в MATLAB. Учебный курс. – СПб.: Питер, 2005. – 512с. 8. Лурье Б.Я., Энрайт П.Дж. Классические методы автоматического управления. – СПб.: БХВ – Петербург, 2004. – 640с. |

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| **Module name** | **MEE - В67 Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Basics of ethics and anti-corruption culture:  Associate Professor Sarsekeyev Masat Mukashevich  Ecology and life safety:  Associate Professor Abikenova Asel Amangeldievna (Russian, Kazakh)  PhD Begimbetova Ainur Serikbaevna (English)  Economics, Entrepreneurship, Leadership and Innovation:  Professor Baitenova Laura Maratovna |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 150 hours  **Class hours**:  Lectures-15; Practical classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Philosophy, Modern history of Kazakhstan |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  Basics of ethics and anti-corruption culture: obtaining knowledge about state measures to combat corruption, understanding the essence of the moral and moral problems of the life of modern society, as well as factors, principles and conditions that affect their functioning in the field of ethical and legal relations.  Ecology and life safety: The study of the features of the functioning of technical systems, as well as natural processes and phenomena, as sources of environmental and man-made danger. Economics, Economics, Entrepreneurship, Leadership and Innovation:to teach students the scientific and practical foundations of organizing entrepreneurial activity, the results of the innovation process, and the specifics of the current situation.  **LEARNING OUTCOMES:**  **Bachelors know**:  - own ethical and legal categories, terminology, conceptual apparatus related to combating corruption;  - represent the importance and necessity of legal and organizational support for combating corruption.  - readiness for rational actions in extreme conditions;  - safety precautions and measures to protect people from production factors.  market mechanisms of the enterprise in the existing legal, economic, financial and administrative environment;  - forms and conditions of business organization;  - the essence of economic phenomena and changes in the enterprise, their relationship and interdependence;  - state mechanisms for regulation and support of innovations;  - theoretical concepts of leadership organization;  **are able**:- comprehensively and critically analyze the required array of information.  - independently draw conclusions, analyze and process the required amount of diverse information of legal processes and phenomena of social behavior.  - identify and analyze natural and anthropogenic environmental processes and possible ways of their regulation;  - to classify emergency situations of technogenic, natural, socio-political and military character; evaluate risk levels according to the degree of acceptability.  - determine the level of emergencies according to the criteria  - demonstrate their knowledge and skills in the field of innovation, including knowledge in the organization of domestic enterprises in the field of innovation;  - apply their knowledge to create an effective system of innovative business, as well as have the necessary competencies to solve and justify tasks in the field of research;  -use information about the experience and theoretical foundations of innovative business for decision-making, taking into account social, economic, scientific and ethical considerations;  **COMPETENCES:** - be able to analyze and evaluate the level of organization of production;  - be able to independently make economic, production and management decisions;  - correct assessment of the real economic situation in the changed environment;  - be able to identify ways and resources to improve the performance of the enterprise. |
| **Content** | The training course, which allows the student to gain knowledge about state measures to combat corruption, makes it possible to understand the essence of modern worldview problems, their sources and theoretical solutions, as well as the principles and ideals that determine the goals, means and nature of people's activities. He studies the impact of technological processes on the state of the environment, types and sources of pollution, methods and methods of cleaning, categorization of the environmental hazard of production and sanitary protection zones, as well as the parameters and characteristics of emergency situations of a different nature, forecasting their consequences, methods for determining the amount and structure of losses. Mastering the concept of the modern economy, the transition of the economy of Kazakhstan to a fundamentally new development trajectory. Organization of business activities for the production and sale of competitive products in demand. The study of the main theories of motivation, leadership for solving managerial problems. Knowledge of modern technologies of personnel management. Studying the main models of innovative development, methods for implementing innovations; interconnections between innovative activity and competitive development of enterprises. |
| **Current control** | Calculation and graphic works -3, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | **Basics of ethics and anti-corruption culture**  1. Актуальные проблемы борьбы с коррупцией в Республике Казахстан / О. А. Абдыкаримов. - Астана: Акад. гос. упр. при Президенте РК, 2005. - 19 с.  2. Беловоротничковая" преступность в США через призму мирового финансово-экономического кризиса: Моногр. /О. Г. Карпович, Н. А. Шулепов. - М.: ЮНИТИ- ДАНА, 2014. - 207 с. - Библиогр.: 195 с.  3. Болеев Т.К. Психологические механизмы коррупционного поведения// Государственное управление и государственная служба №1,2015.  4. Бюрократия, коррупция и эффективность государственного управления / В. Д. Андрианов. - М.: Волтерс Клувер, 2009. - 248 с. - Библиогр.: 234 с.  5. Власть, коррупция и честность: Науч. изд.: Пер. с англ. / А. А. Рогоу. - М.: Изд-во РАГС, 2015. - 176 с. - (Антология зарубеж. и отеч. мысли)  6. [Закон РК О противодействии коррупции](https://aues.kz/frontend/web/uploads/against-corruption/1592382843_2uzt-k.pdf)  7. Коррупция и государство: Причины, следствия, реформы: Пер. с англ. О.А.Алякринского / С. Роуз-Аккерман. - М.: Логос, 2016. - 356 с.  **Ecology and life safety**   1. Конституция РК (<http://adilet.zan.kz/rus)> 2. Экологический кодекс РК (<http://adilet.zan.kz/rus>) 3. Закон Республики Казахстан от 11 апреля 2014 года «О гражданской защите» [(h](http://adilet.zan.kz/rus))t[tp://adilet.zan.kz/rus)](http://adilet.zan.kz/rus)) 4. Достияров, А. М. Инженерлік экология: оқу құралы / А.М. Достияров, А.К. Исатаева; ҚР Ауыл шаруашылық мин-гі, С. Сейфуллин атынд. ҚАТУ. – Астана, 2018. - 148 б. 5. Экология және тұрақты даму. Оқұлық. Нұрғызарынов А., Шілдебаев Ж. Фолиант 2014. 344т.п. 6. Аппатан құтқару жұмыстарын қауіпсіз ұйымдастыру: оқу құралы. Шарипханов С. Фолиант. 2016. 160 т.п.   **Economics, Entrepreneurship, Leadership and Innovation**  1. Экономика инноваций: курс лекций / под общ. ред. проф. Н.П. Иващенко. — М.: МАКС Пресс, 2016.  2. Экономика инноваций: учебное пособие. — М.: Экон. ф-т МГУ им. М.В. Ломоносова, 2016. — 310 с  3. Экономика организации (предприятия) : учебник / В.Д. Грибов, В.П. Грузинов, В.А. Кузьменко. — 10-е изд., — М. : Кнорус, 2016. — 416 с.  4. Экономика предприятия : учебник / коллектив авторов ; под ред. В.И. Гришина, Я.П. Силина. — Москва : КНОРУС, 2019. — 472 с.  5. Организация, планирование и управление производством/под ред. Н.И.Новицкого.-М.: «Кнорус», 2011 |

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| **Module name** | **MEE -В68 Basics of scientific research and academic writing** |
| **Semester(s) in which the module is taught** | 8 |
| **Person responsible for the module** | Associate Pofessor Dosmakhanova Raikul Amandykovna |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Practical classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Kazakh (Russian) language 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to give an idea of the style and language of academic writing; to prepare students for the use of specific tools for the formulation and conduct of scientific research in the preparation of the final qualifying work..  **LEARNING OUTCOMES:**  **Bachelors know**:  - the structure of academic writing, its design;  - the history of the emergence and development of science;  - methods of theoretical and empirical research;  - the essence of fundamental and applied science;  **are able**:  - work with scientific and technical literature and special websites on the Internet;  - formulate the purpose, objectives, subject and object of scientific work;  - navigate the literature on the topic, use bibliographic resources and search engines for scientific work.   * **COMPETENCES:** to carry out the solution of cognitive and communicative tasks, communicate in the professional sphere, demonstrating a high level of inform. |
| **Content** | At the lectures, the student receives the necessary knowledge on the modern foundations of scientific research, masters’ scientific methods of studying professional tasks. In practical classes, cognitive and communicative tasks are solved. The self-study work under teacher’s supervision provides for the fulfillment of a sufficient number of tasks of both linguistic and creative nature. |
| **Current control** | Semester works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1 Academic writing. From research to text: textbook and workshop for universities / Yu.M. Kuvshinskaya et al. - Moscow: Yurayt Publishing House, 2022. - 284 p. https://urait.ru/bcode/494312 (subscription access).  2 Bayakhmetova A.A., Dusenbina M.J. Academic writing. Language and style of academic writing: A textbook. - Kostanay: A.Baitursynov KSU, 2019. - 106 p. <http://test.ksu.edu.kz/files/TB/book/gsf/uchebnoe_posobie_akademicheskoe_pis_mo_2019_12_10_07_58_30_936.pdf>  3 Bubenchikov A.A. Fundamentals of scientific research: textbook. stipend. - Omsk: Publishing House of OmSTU, 2019. - 158 p. https://disk .yandex.kz/i/NBDMU0Qwk-8AUg 4 Burykin A.D. et al. Fundamentals of scientific research: methodology and recommendations. Study guide. - Yaroslavl: LLC "PKF "SOYUZ-PRESS", 2020– - 136 p. <https://yadi.sk/i/MTOvMo8xTVWfNg>  5 Drechinsky V. A. Methodology of scientific research: textbook for universities. - M.: Yurayt Publishing House, 2021. - 274 p. 2021. https://urait.ru/bcode/472413 (subscription access)  6 Kvitsinia M.B. Academic writing. Study guide. - Sukhumi: ASU, 2018. - 145 p. <http://apsnyteka.org/file/Kvitsiniya_M_Akademicheskoe_pismo_2018.pdf>  7 Culture of speech. Scientific speech: a textbook for universities / V.V. Khimik et al. - Moscow: Yurayt Publishing House, 2022. - 270 p. https://urait.ru/bcode/490882 (subscription access).  8 Shklyar M.F. Fundamentals of scientific research. Textbook for bachelors. - 4th ed. - Moscow: Publishing and Trading Corporation "Dashkov and Co.", 2012. - 244 p. <https://yadi.sk/i/3_6xz0BcYyDB0w>  9 Eismont N. G. Theoretical foundations and practice of scientific research: studies. stipend. - Omsk: Publishing House of OmSTU, 2018. - 98 p. <https://www.omgtu.ru/general_information/faculties/radio_engineering_department/department_of_quot_physics_quot/lib_pfys/280402-280302/Teor_osnovi_prakt_nauch_issl.pdf> |

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| **Module name** | **MEE - В69-1 Fundamentals of digital technology** |
| **Semester(s) in which the module is taught** | 8 |
| **Person responsible for the module** | Senior lecturer Akimenkov Mikhail Veniaminovich (Russian)  Senior lecturer Mustagulova Bopa Zhumanbaevna (Kazakh)  Senior lecturer Arystanov Nuri Nigmatullaevich (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Fundamentals of microprocessor technology" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Mathematics,  Информационно-коммуникационные технологи  Computer network technologies in electrical engineering |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  the formation of the minimum knowledge in the field of application of digital devices among students, which will allow the young specialist to improve in the future, independently make technical decisions on the use of digital devices at the international, regional and national levels, as well as the skills of their construction, programming in the Assembler language and use in systems energy process management.  **LEARNING OUTCOMES:**  **Bachelors know**:  - the basics of building logic elements used in the architecture of digital devices;  - creation of a logical structure scheme that implements a certain algorithm;  - classification of functional units of combinatorial logic;  - the main characteristics of the storage devices of digital systems.  **are able**:  - correctly choose a digital device to implement the required control algorithm;  - use the Assembler language when programming integrated circuits.  **COMPETENCES**:  - analyze and make a decision on the compliance of the capabilities of digital devices with the tasks of control algorithms. |
| **Content** | The discipline considers the main semiconductor elements based on p-n junctions, the logical foundations for building semiconductor devices on their basis, as well as functional units of combinatorial logic. We study the use of Assembler to implement control algorithms in microprocessor systems. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1.Сажнев А.М., Цифровые устройства и микропроцессоры : учеб. пособие / А.М. Сажнев. - 2-е изд., перераб. и доп. - М : Юрайт, 2020. - 140 с. - (Высш. образование)  2. НОУ «ИНТУИТ» Основы цифровой техники – М. «ИНТУИТ», 2018.  М. В. Акименков Методические указания по выполнению лабораторных работ по курсу «Основы цифровой (микропроцессорной) техники -А.: АУЭС, 2015.  3. М.В.Акименков Конспект лекций по основам цифровой техники-А.: АУЭС, 2019.  4. А. А. Копесбаева, В. М.Тарасов Цифровая техника и микрокон-троллеры , МУ к выполнению лабораторных работ-А.: АУЭС, 2012.  5. А. Л. Марченко Основы электроники. Учебное пособие для вузов- М.: ДМК Пресс,2012  6. М. В. Акименков Методические указания по выполнению лабораторных работ по курсу «Основы цифровой техники -А.: АУЭС, 2021.  7. М. В. Акименков Методические указания по выполнению расчетно-графических работ по курсу «Основы цифровой техники»-А.: АУЭС, 2021.  8. М. В. Акименков Методические указания по выполнению расчетно-графической работы № 3 по курсу «Основы цифровой техники» - А.: АУЭС, 2019. |

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| **Module name** | **MEE - В69-2 Fundamentals of microprocessor technology** |
| **Semester(s) in which the module is taught** | 8 |
| **Person responsible for the module** | Senior lecturer Akimenkov Mikhail Veniaminovich (Russian)  Senior lecturer Mustagulova Bopa Zhumanbaevna (Kazakh)  Senior lecturer Arystanov Nuri Nigmatullaevich (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Fundamentals of digital technology" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision (SSTS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 90 hours  **Class hours**:  Lectures-15; Laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours**: 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Mathematics,  Информационно-коммуникационные технологи  Computer network technologies in electrical engineering |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  the formation of students' theoretical foundations for information conversion, the foundations of the logical construction of microprocessor systems (MPS), the architecture of the MPS, the circuit implementation of individual MPS nodes, the use of Assembler to implement control algorithms in microprocessor systems.  **LEARNING OUTCOMES:**  **Bachelors know**:  - fundamentals of building the architecture of microprocessor systems;  - principles of creating a microprocessor system to perform a specific technological task;  - writing programs in Assembler and writing them to the microcontroller using programmers;  **are able**:  - correctly choose a microprocessor device to implement the required control algorithm;  - use when programming integrated circuits.  **COMPETENCES**:  - analyze and make a decision on the correspondence of the capabilities of the MPS to the tasks of control algorithms.. |
| **Content** | The discipline considers the theoretical foundations of information transformation, the logical foundations for building microprocessor systems (MPS), the architecture of the MPS, the circuit implementation of individual MPS nodes. We study the use of Assembler to implement control algorithms in microprocessor systems. |
| **Current control** | Calculation and graphic works -2, midterm control-2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1.Сажнев А.М., Цифровые устройства и микропроцессоры : учеб. пособие / А.М. Сажнев. - 2-е изд., перераб. и доп. - М : Юрайт, 2020. - 140 с. - (Высш. образование)  2. НОУ «ИНТУИТ» Основы цифровой техники – М. «ИНТУИТ», 2018.  М. В. Акименков Методические указания по выполнению лабораторных работ по курсу «Основы цифровой (микропроцессорной) техники -А.: АУЭС, 2015.  3. М.В.Акименков Конспект лекций по основам цифровой техники-А.: АУЭС, 2019.  4. А. А. Копесбаева, В. М.Тарасов Цифровая техника и микрокон-троллеры , МУ к выполнению лабораторных работ-А.: АУЭС, 2012.  5. А. Л. Марченко Основы электроники. Учебное пособие для вузов- М.: ДМК Пресс,2012  6. М. В. Акименков Методические указания по выполнению лабораторных работ по курсу «Основы цифровой техники -А.: АУЭС, 2021.  7. М. В. Акименков Методические указания по выполнению расчетно-графических работ по курсу «Основы цифровой техники»-А.: АУЭС, 2021.  8. М. В. Акименков Методические указания по выполнению расчетно-графической работы № 3 по курсу «Основы цифровой техники» - А.: АУЭС, 2019. |

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| **Module name** | **MEE -В70 Pre-graduation internship** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Head of department Tergemes K. T.,  Head of department Umbetkulov E.K.,  Head of department Shynybai Zh.S. |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory** |
| **Teaching methods** | Lectures, practicals works |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours**: 210 hours  **Class hours**:  Practical classes – 210 |
| **Credits** | 7 |
| **Required and recommended prerequisites for joining the module** | Work placement internship 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** preparing the student for the final qualifying work by studying and selecting the necessary materials and documentation on the subject of the graduation project (final work)..  **LEARNING OUTCOMES:**  **Bachelors know**:  - maintenance of systems for control and management of production, transmission and distribution of electricity using hardware and software and complexes;  - the structure and content of the organization's activities  - technological processes for the production of products of electric power facilities  **are able**:  - carry out maintenance of electrical equipment;  - carry out preventive inspections of electrical equipment;  - carry out work on the installation and dismantling of electrical equipment..  **COMPETENCES:**  - understand the essence and social significance of your future profession, show a steady interest in it  - organize their own activities, choose standard methods and methods for performing professional tasks, evaluate their effectiveness and quality  - use information and communication technologies in professional activities. |
| **Content** | Practice is a type of educational activity aimed at the formation, consolidation, development of practical skills and competencies in the process of performing certain types of work related to future professional activities. Industrial (pre-diploma) practice is aimed at deepening the initial practical experience of the student, developing general and professional competencies, testing his readiness for independent work, as well as preparing for the completion of final qualification work in organizations of various organizational and legal forms. As a result of passing the production (pre-diploma) practice, implemented as part of the training program for mid-level specialists for each type of professional activity, the student must acquire practical experience in the field of electric power industry |
| **Current control** | tests |
| **Final control** | Graded test |
| **Study and examination requirements** | PC, Software, laboratory facilities |
| **References** | 1. Агафонов А. И., Современная релейная защита и автоматика электроэнергетических систем: учеб. пособие / А. И. Агафонов, Т.Ю. Бростилова, Н.Б. Джазовский. - 2-е изд.,перераб. и доп. - М : Инфра-Инженерия, 2020; Вологда. - 300 с.:ил., табл. 2. Менумеров, Р. М. Electrical safety: учеб. пособие / Р.М. Менумеров. - 4-е изд., стер. - СПб : Лань, 2020. - 196 с.  3. Электропривод типовых производственных механизмов : учеб. пособие / Ю.Н. Дементьев, В.М. Завьялов, Н.В. Кояин и др.; Томский политехнический ун-т. - М : Юрайт, 2020. - 404 с. - (Высшее образование)  4. Кудинов А. А., Тепловые электрические станции. Схемы и оборудование: учеб. пособие / А.А. Кудинов. - М.: ИНФРА-М, 2021. - 325 с.: ил. - (Высшее образование: Бакалавриат)  5. Лыкин А. В., Электроэнергетические системы и сети : учебник для вузов / А.В. Лыкин; Новосибирский государственный технический университет. - М.: Юрайт, 2020. - 360 с. - (Высшее образование)  6. <https://rza.org.ua/down/view/Osnovi-releynoy-zashchiti_11.html>  7. <https://pro-rza.ru/> |