



Module Handbook

for the degree program

AUTOMATION and CONTROL

(Direction: Bachelor of Engineering and Technology)



Almaty, 2020-2022

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Curriculum of postgraduate studies

6B07108 – Automation and control









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| **Module name** | **MAC-B01 - Modern history of Kazakhstan** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Associate Professor Baidildina Fellan Saule Khairullovna (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  *Compulsory* |
| **Teaching methods** | Lectures, practical seminars, term paper, 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** | General education school program of the history of Kazakhstan course, world history and geography. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  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** | Midterm control 2, tests |
| **Final control** | State exam |
| **Study and examination requirements** | Personal computer |
| **References** | 1. Istoriya Kazahstana. V 5-ti tomah. 3- 5 Volume. Almaty: Atamura, 2000., 2010. 2. Ayagan B., Auanasova А., Suleimenov А. Noveishaya istoriya Kazahstana: Krisis I raspad sovetskoi sistemy. I Volume: Popular science edition. Ser. "Chronicle of Independence". - Almaty: ТОО «Litera-М», 2011. 3. Ayagan B.  Noveishaya istoria Kazahstana. 2 Volume: Vyhod iz krizisa/ B Ayagan; Auanasova А., Kudaibergenov R.- Almaty: ТОО «Litera-М», 2011. 4. Ayagan B.  Noveishaya istoria Kazahstana. 3 Volume: Ustoichivy Kazahstan / B. Ayagan; Auanasova А., Suleimenov А.- Almaty: ТОО «Litera-М», 2011. 5. Artykbayev Zh.О.; Razdykov S.Z. Istoriya Kazahstana: Course book. – Astana: Foliant, 2007. 6. Kazakstan (Kazak eli) tarihy. – consisting of 4 textbooks. Almaty, Kazak university, 2016. 7. Official website of the President of the Republic of Kazakhstan [-http://www.akorda.kz](http://www.akorda.kz) 8. Official site of KISS (Kazakhstan Institute for Strategic Studies - <http://www.kisi.kz/site.html?en=0> |

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| **Module name** | **MAC-B02 - 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 mathematics 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 mathematics.  **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 Mathematics. 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 Mathematics. 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 mathematics. 1 part. – M.: Rolf, 2007. – 288 p.  4. Individual tasks in higher mathematics: 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 mathematics: 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. Mathematics 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. Mathematics 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> |
| **Module name** | **MAC-B02 - 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** | **Mathematics 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 mathematics. 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** | **MAC-B03 - Foreign Language 1,2** |
| **Semester(s) in which the module is taught** | 1, 2 |
| **Person responsible for the module** | Zussupova Akbota Utepbergenovna (kaz, rus) |
| **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. 6. 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** | **MAC-B04 - Kazakh language 1,2** |
| **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** | Personal computer |
| **References** | 1. Abduova B. S., Asanova U. O. The 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.. The 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. The Kazakh language: textbook for the secondary level. National Testing Center. - Astana: 2017.  5. Zhekeeva K. O. The 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. The 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. The 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. The 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. The Kazakh language: textbook. - Almaty: Kazakh University, 2014.  12. Kulmanov K. S., Abduova B. S. The 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** | **MAC-B04 – Russian language 1, 2** |
| **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;  - to compose everyday, social and cultural, official and business texts in accordance with generally accepted norms, functional orientation, using lexical-grammatical and pragmatic material of a B1 level certain certification that is adequate to the goal. |
| **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 Bukejxanova R.K., Musabaeva Z.T. Prakticheskij kurs russkogo yazy`ka. Uchebnoe posobie/ R.K. Bukejxanova, Z.T. Musabaeva. – Almaty`: AUE`S imeni Gumarbeka Daukeeva, 2021. – 77 s. – URL: <http://libr.aues.kz/facultet/101_TEF/142_Kafedra_yazikovih_znaniy/593_Prakticheskiy_kurs_russkogo_yazika/DRLQJVg6eCFYKx7MmfdotjuHs2AWE4.pdf>  2. Dosmaxanova R.A. Russkij yazy`k. Uroven` В1: Uchebnoe posobie dlya studentov texnicheskix vuzov. Chast` I/R.A. Dosmaxanova. – Almaty`, 2021. – 131 s.  3 Evtyugina A.A. Russkij yazy`k i kul`tura rechi: kurs lekcij [E`lektronny`j resurs]: uchebnoe posobie. – Ekaterinburg: Ros. gos. prof.-ped. un-t, 2019. – 269 s. – URL: http://elar.rsvpu.ru/978-5-8050-0669-3  4 Ermachenkova V.S. Povtoryaem padezhi i predlogi: korrektirovochny`j kurs dlya izuchayushhix russkij yazy`k kak vtoroj (e`lektronnoe izdanie). − 3-e izd. − SPb. : Zlatoust, 2014. − 172 s. − URL: https://yadi.sk/i/ObYeDABXjks\_3g.  5 Interaktivny`e avtorskie kursy` Instituta Pushkina dlya urovnej A1-C1. – URL: http://ac.pushkininstitute.ru  6 Levental` I.V. i dr. Testy` po russkomu yazy`ku: V1. Otkry`ty`e e`kzamenacionny`e materialy` SPbGU. – SPb: Zlatoust, 2020. – 140 s.  7 Mnogoyazy`chny`j sajt dlya izucheniya russkogo yazy`ka. (Multilingual website for learning Russian). – URL: https: // russky.info/ru  8 Nacional`ny`j korpus russkogo yazy`ka. (National corpus of the Russian language). – URL: www.ruscorpora.ru  9 Nurmaxanova M.K. Russkij yazy`k dlya texnicheskix special`nostej vuzov: Uchebnoe posobie. – Almaty`: AUE`S, 2018. – 156 s.– URL: http://libr.aues.kz/facultet/101\_TEF/142\_Kafedra\_yazikovih\_znaniy/406\_Russkiy\_yazik\_dlya\_tehnicheskih\_spetsialnostey\_vuzov/x2Si3D9f87NpzGTKIo5brdPO4uJQC1.pdf  10 Portal gosudarstvennogo yazy`ka Respubliki Kazaxstan (dvuyazy`chny`e otraslevy`e slovari). (Portal of the state language of the Republic of Kazakhstan (bilingual industry dictionaries)).– URL: www.til.gov.kz/wps/portal  11 Portal «Obrazovanie na russkom». Uroven` B1. – URL: https:// pushkininstitute. ru/certified1  12 Russkij yazy`k. Uchebnoe posobie dlya studentov kazaxskix otdelenij universitetov (bakalavriat)/ Pod red. Axmed`yarova K.K., Zharky`nbekovoj Sh.K., Muxamadieva X.S. – Almaty`: Қazaқ universitetі, 2012. – 226 s. − URL: https://edu.semgu.kz/ebook/umm/10b7f6c6-bf4f-11e4-bd4b-.pdf |
| **Module name** | **MAC-B05 - Physical education** | |
| **Semester(s) in which the module is taught** | 1,2,3,4 | |
| **Person responsible for the module** | Teacher Turarov Erzhan Zhanatovich (rus)  (kaz)  (eng) | |
| **Language** | Kazakh, Russian, English | |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  *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** | differentiated credit | |
| **Study and examination requirements** | Gym, sports equipment | |
| **References** | Teoriya i metodika obucheniya predmetu "fizicheskaya kul`tura". Vodny`e vidy` sporta. Uchebnoe posobie / pod red. Bulgakova N. Zh. M.: Yurajt, 2019. 304 s.  Chernov I.V., Revunov R.V. Organizaciya uchebno-trenirovochnogo processa po fizicheskoj kul`ture v vy`sshem uchebnom zavedenii (na primere tyazhyoloj atletiki). M.: Lan`, 2019. 104 s.  E`lektivny`e kursy` po fizicheskoj kul`ture. Prakticheskaya podgotovka / pod red. Zajcev A. A. M.: Yurajt, 2020. 228 s. | |

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| **Module name** | **MAC-B06 - Information and Communication Technology** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Zhumagulova Sholpan Pernebaikyzy (rus)  (kaz)  (eng) |
| **Language** | English |
| **Relation to curriculum** | Compulsory |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation-graphic works, Bachelor’s self-study work under teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -30; Practice -15; SSW – 89 (SSTS -10)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Course of school mathematics, computer science |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** mastering of students’ professional and personal competences to use modern information communication technologies in different areas of professional activity, for scientific and practical operation, self-educational and other purposes., The course realizes educational purposes along with practical purpose, promoting outlook extension, and general culture and education increase.  **LEARNING OUTCOMES:**  - what economic and political factors contributed to the information and communication technologies development;  - about the architecture of computing systems, operating systems and networks;  - features of various operating systems;  - possibilities of modern information technologies and tendencies of their development;  - the architecture, be able to calculate and evaluate performance indicators of supercomputers.  **are able**:  - to identify the main trends that students will be able to;  - process vector and raster images;  - create multimedia presentations;  - use information resources to search and store information;  - work with spreadsheets, perform data consolidation, build diagrams;  - work with databases;  - apply methods and means of information protection;  - design and create simple websites;  - use different social communication platforms;  - use various forms of e-learning to expand professional knowledge;  - use various cloud services.  **COMPETENCES:**  - make a choice of measuring devices, measure technological parameters;  - apply normative documents in practice, be guided by them when solving technical production issues;  - organize and perform maintenance of complex emergency automatic devices, measuring instruments and alarm systems.  - analyze reference and regulatory literature, prepare technical documentation; - develop technical support for the process control system. |
| **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** | Personal computer, software, laboratory base. |
| **References** | 1. Nurpeisova, T.B. Information and Communication Technologies: textbook / T.B. Nurpeisova, I.N. Kaidash; MES RK. - Almaty : Bastau, 2017. 2. Information-communication technology: textbook / B.A. Urmashev; MES RK. - Almaty : Bookprint, 2016. 3. Information and Communication Technologies=Информационно-коммуникационные технологии: textbook. In 2 parts. Part 1 / D. Shynybekov , R. Uskenbayeva , V. Serbin и др.; Republic of Kazakhstan Ministry of education and science; International information technology university. - 1st ed. - Almaty : IITU, 2017. 4. Information and Communication Technologies=Информационно-коммуникационные технологии: textbook. In 2 parts.Part 2 / D. Shynybekov , R. Uskenbayeva , V. Serbin и др.; Ministry of education and science of the republic of Kazakhstan; International information technology university. - 1st ed. - Almaty : IITU, 2017. 5. Kretschmer T. Information and Communication Technologies and Productivity Growth: A survey of the literature - Paris : OECD, 2012. - 27 p. 6. Kretschmer, Tobias.Information and Communication Technologies and Productivity Growth. - Gtneva : Oecd, 2012. 7. [https://www.washington.edu/doit/what-are-examples-accessible-electronic- and-information-technology-education](https://www.washington.edu/doit/what-are-examples-accessible-electronic-%20%20%20and-information-technology-education) 8. <http://www.washington.edu/accessit/> 9. <https://www.accessify.com/tools-and-wizards/> |
| **Module name** | **MAC-B07 - Algorithms and Data Structures** | |
| **Semester(s) in which the module is taught** | 1 | |
| **Person responsible for the module** | Associate Professor, Cand.tech.sc. Nurgulzhanova Asel Nurgulzhanovna (kaz)  Professor, Cand.phys-math.sc. Moldagulova Aiman Nikolaevna (rus) | |
| **Language** | Kazakh, Russian | |
| **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 | |
| **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** | No | |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to develop knowledge and skills in the of algorithmization field, as well as to give a student knowledge and practical skills in the field of algorithmization, programming, debugging, and testing software products.  **LEARNING OUTCOMES:**  -to own modern computer, information, technologies and software;  - to develop software, mathematical, algorithmic support;  - to analyze reference literature, draw up technical documentation.  **Bachelors know:**  - basic principles of algorithmization;  - methods for describing algorithms and rules for designing flowcharts;  - the structure of programs in C++;  - basic data structures used in languages;  - syntax of the main operators of the C++ language;  **are able**:  - to develop algorithm schemes for solving problems;  - to develop programs in C++;  - to debug and test the created software product using the studied integrated environment;  - to analyze the results.  **COMPETENCES:**  demonstrate practical skills in modern programming language;  demonstrate abilities in the development of algorithmic support. | |
| **Content** | To study general principles of algorithms development, basic algorithmic constructions, control structures, data structures, as well as gain practical skills in using the C ++ programming language when designing logically correct and efficient programs. | |
| **Current control** | Calculation and graphic work -1,2 Midterm control 1,2 tests | |
| **Final control** | Examination | |
| **Study and examination requirements** | PC, Software | |
| **References** | 1. Ermekov N. T., Algoritmizaciya i programmirovanie: uchebnik / N.T. Ermekov. - Almaty` : [Lantar Trejd], 2019.  2. Kancedal S.A., Algoritmizaciya i programmirovanie : ucheb. posobie / S.A. Kancedal. - M : FORUM, 2021: INFRA-M.  3. Lippman Stenli B., Lazhoje Zhozi, Mu Barbara E`. Yazy`k programmirovaniya C++. Bazovy`j kurs. M.: Ozon, 2017.  4. Potopaxin V. Iskusstvo algoritmizacii. - M.: «DMK Press», 2011.  5. Straustrup B. Yazy`k programmirovaniya C++. – M.: 2012.  6. Golicyna O.L., Popov I.I. Osnovy` algoritmizacii i programmirovaniya. Uchebnoe posobie. M.: «Forum», 2015.  7. Greg Perri, Din Miller. Programmirovanie na C dlya nachinayushhix. 3-e izdanie. - M.: E`ksmo, 2015.  8. Se`dzhvik R. Algoritmy` na C++. – M., «Vil`yams», 2014. | |

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| **Module name** | **MAC-B08 - Physics** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Kaz Nysanbayeva S.K.  Rus Salamatina А.М.  Eng Salamatina A. M. |
| **Language** | Kazakh/Russian/ English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works 1,2,3, Bachelor’s self-study work under teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15; Laboratory classes - 15; Practical classes -15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and Communication Technologies, Mathematics 1 |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** essence disclosure of the basic ideas, laws, theories of classical and modern physics in their internal relationship; the formation of students' skills and abilities to solve generalized typical problems of the discipline from various fields of physics.  **LEARNING OUTCOMES:**  **Bachelors know**: basic theories of classical physics, principles, laws and limits of their applicability;  **are able**:  -to process the data obtained in the experiment and present them in the form of tables and graphs; - evaluate errors and analyze the results of a physical experiment, mathematically model physical situations; -apply theoretical knowledge to solve specific physical problems and situations; - organize and conduct simple physical experiments; - work with modern measuring devices;  **Competences:**  - are able to assess the degree of reliability of the study results;  - demonstrate the skills of creative thinking, independent, cognitive activity, the ability to simulate physical phenomena using a computer.  The discipline creates the basis for the professional activity of bachelors in the field of automation and control. Sections are studied: mechanics, statistical physics and thermodynamics, electrostatics and direct current, magnetism, skills and abilities are formed in the use of fundamental laws, as well as methods of physical research to solve theoretical and experimental problems from various fields of physics, analyze the results of a physical experiment. |
| **Content** |  |
| **Current control** | Control work, test,Midterm control, SSW, CGW, SSTS |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software, laboratory facilities. |
| **References** | 1. Fizika. Mexanika. Zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan әdіstemelіk nұsқaular.- Almaty`: AE`zhBU, 2015 zh.  2. Statistikaly`қ fizika zhәne termodinamika. Zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan әdіstemelіk nұsқaular. /Bajpaқbaev T.S., Қarsy`baev M.Sh., Sy`zdy`қova R.N. - Almaty`: AE`ZhBU, 2011 zh.- 33b.  3. E`lektrostatika zhәne tұraқty` tok. Zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan әdіstemelіk nұsқaular (Barly`қ mamandy`қ pen barly`қ oқu tүrіne arnalғan )T.S. Bajpaқbaev, L.V. Zavadskaya, L.X. Mazhitova, L.A. Tonkonogaya. - Almaty`: AE`ZhBI, 2007.- 35 b.  4. E`lektr togy` zhәne magnetizm: Zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan әdіstemelіk nұsқaular.T.S.Bajpaқbaev, Zh.Iskakov,S.N. Sarsenbaeva-Almaty`: AE`ZhBU, 2017 zh.- 33b.  5. Terbelіster. Oқy`tudy`ң barly`қ bӛlіmіnің zhәne barly`қ mamandy`қ studentterі үshіn zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan ӛdіstemelіk nұsқau. - Almaty`: AE`zhBU, 2015  6. Kvantty`қ fizika. Oқy`tudy`ң barly`қ bӛlіmіnің zhәne barly`қ mamandy`қ studentterі үshіn zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan ӛdіstemelіk nұsқau. - Almaty`: AE`zhBU,2015.  7. Tolқy`ndy`қ optika. Oқy`tudy`ң barly`қ bӛlіmіnің zhәne barly`қ mamandy`қ studentterі үshіn zertxanaly`қ zhұmy`stardy` ory`ndauғa arnalғan әdіstemelіk nұsқau. - Almaty`: AIE`S, 2008.  8. Sy`zdy`қova R.N., Saurova K.S. Fizika 1. 5V074600 – Ғary`shty`қ texnika zhәne texnologiyalar mamandy`ғy`ny`ң studentterі үshіn dәrіster zhiy`nty`ғy`. - Almaty`: AE`zhBU, 2019. -88 b.  9. Sy`zdy`қova R.N., Saurova K.S. Fizika 1. 5V074600 – Ғary`shty`қ texnika zhәne texnologiyalar mamandy`ғy`ny`ң studentterі үshіn esepteu-sy`zba zhұmy`stardy` ory`ndau bojy`nsha әdіstemelіk nұsқauly`қtar . - Almaty`: AE`zhBU, 2019.  10. R.N. Sy`zdy`қova, S.N.Sәrsenbaeva. Fizika. 5V100200 – Aқparatty`қ қauіpsіzdіk zhүjelerі mamandy`ғy`nda oқity`n studentterge arnalғan dәrіster zhinaғy`. - Almaty`: AE`zhBU, 2018. - 114 b.  11. Қojshy`baev N. Mexanika.-Almaty`; Ziyat-press,2005.-t.1  12. Қojshy`baev N. Fizika.Oқu құraly`. T.1: Mexanika.Molekulaly`қ fizika.- Almaty`;2001.  13. Қojshy`baev N. E`lektr zhәne magnetizm.-Almaty`; Ziyat-press,2006.-t.3  14. Қojshy`baev N. Fizika.Oқu құraly`. T.2: E`lektrodinamika negіzderі. Terbelіster men tolқy`ndar.Optika. Kvantty`қ zhәne atom yadrosy`.-A, 2001  15. Қojshy`baev N.Fizika T.4. Optika. Yadro. Atom. E`lementar bөlshekter.-A,,2006  16. Vol`kenshtejn V.S. Zhalpy` fizika kursy`ny`ң esepter zhinaғy`. –Almaty`.: Nur-print, 2012.  17. Bajpakbaev T.S., Karsy`baev M.Sh. Zhalpy` fizika kursy` esepter zhinaғy`. –Almaty`.: AE`zhBU, 2014.  18. Trofimov T.I. Fizika kursy`. – M.: Akademiya., 2006. |

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| **Module name** | **MAC-B09 - Training Practice. Designing in AutoCAD, Solid Works / Computer Graphics Basics** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Kaz Koilybayeva R. K.  Rus Koilybayeva R. K  Eng 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 Technology |
| **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. Dіnasy`lov A. D., Yax``yaev E`. A., Mazhiev E. M. Konstruktorly`қ құzhattardy` ory`ndaudy`ң zhalpy` erezhelerі: Oқu құraly`. - Almaty`: AE`zhBU, 2016.  2. Aman K.P., AutoCAD-ta zhobalau : oқu құraly` / K.P. Aman. - Almaty`, 2021. - 188 b.  3. Dinasy`lov, A.D. Osnovny`e trebovaniya k vy`polneniyu konstruktorskoj dokumentacii: ucheb.posobie / A.D. Dinasy`lov. - Almaty`, 2016.  4. Inzhenernaya 3D - komp`yuternaya grafika : uchebnik i praktikum. T.1 / A.L. Xejfecz, A.N. Loginovskij, I.V. Butorina i dr.; pod red. A. L. Xejfecza. - 3-e izd., pererab. i dop. - M. : Yurajt, 2021. - 330 s.  5. Babenko V.M., AutoCAD Mechanical : ucheb. posobie / V.M. Babenko, O.V. Muxina; Sevastopol`skij gosudarstvenny`j un-t. - M : INFRA-M, 2022. - 143 s. - (Vy`sshee obrazovanie: Bakalavriat) |

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| **Module name** | **MAC-B10-1 - C++ programming technologies in automation issues** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Associate Professor, Cand.tech.sc. Nurgulzhanova Asel Nurgulzhanovna (kaz)  Associate Professor, PhD Toibaeva Shara Dzholdaspekovna (kaz)  Professor, Cand.phys-math.sc. Moldagulova Aiman Nikolaevna (rus, eng) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective "Software implementation of engineering problems in C ++" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision |
| **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 (in English)  Algorithms and data structures |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** gaining knowledge in the field of modern programming technologies, acquiring practical programming skills in the high-level language C ++.  **LEARNING OUTCOMES:** study of the programming technologies basics in a basic procedural-oriented algorithmic language, the programming languages classification, the basics of structured programming, visual and object-oriented programming, methods for developing, debugging and testing programs.  **Bachelors know:**  - theoretical foundations of program design;  - methods and software for solving technical tasks;  - ways of debugging programs;  - features of the complex data types use in software implementation;  - basic concepts of object-oriented programming**;**  **are able to:**  - characterize the initial and output data of the tasks being solved, as well as the forms of their presentation;  - fulfill the task statement;  - analyze possible methods for solving tasks and make their reasonable choice;  - to develop algorithms and programs in C ++ for solving tasks on a computer;  - use various implementation methods to solve technical tasks;  - create programs using visual components;  - compile and debug programs.  **COMPETENCES:**  **-** demonstrate practical skills in modern software development tools;  - demonstrate skills in modern programming technologies;  - demonstrate the ability to develop software, mathematical, algorithmic support. |
| **Content** | Basic concepts and development stages of programming technology. Complex data types: arrays, records, sets and files. Array sorting methods. Matrix processing. Functions in C++ and function parameters. Pointers. Structures and associations. Heap work. Dynamic data structures. Working with files. C++ language classes. Inheritance and polymorphism. Software implementation of automation tasks in C++. |
| **Current control** | Calculation and graphic works -1,2,3 Midterm control 1,2 tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | 1. Gagarina L.G., Texnologiya razrabotki programmnogo obespecheniya : ucheb. posobie / L.G. Gagarina, E.V. Kokoreva, B.D. Sidorova-Visnadul; pod red. L.G. Gagarinoj. - M. : FORUM: INFRA-M, 2021. - 400s. - (Vy`ssh.obrazovanie. Bakalavriat).  2. Anisimov, A.E. Sbornik zadanij po osnovam programmirovaniya.- M.: Internet Un-t Inform. Texnologij, 2014: Binom.- 351s.  3. Lupin S.A., Texnologii parallel`nogo programmirovaniya : ucheb. posobie /S.A. Lupin, M.A. Posy`pkin. - M. : FORUM: INFRA-M, 2020. - 206 s. - (Vy`ssh.obrazovanie).  4. Chernikov B.V., Ocenka kachestva programmnogo obespecheniya : praktikum:ucheb.posobie / B.V. Chernikov, B.E. Poklonov. - M. : ID FORUM-INFRA-M, 2020. - 400 b. - (Vy`ssh. obrazovanie).  5. Dejtel, X.M. Kak programmirovat` na S++.- SPb.: Binom, 2011.- 1454s. |

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| **Module name** | **MAC-B10-2 - Software implementation of engineering problems in C++** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Associate Professor, Cand.tech.sc. Nurgulzhanova Asel Nurgulzhanovna (kaz)  Associate Professor, PhD Toibaeva Shara Dzholdaspekovna (kaz)  Professor, Cand.phys-math.sc. Moldagulova Aiman Nikolaevna (rus, eng) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with " C++ Programming technologies in automation issues " |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision |
| **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 (in English)  Mathematics 1  Algorithms and data structures |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** getting knowledge by students in the field of modern software development technologies application for solving engineering problems, acquiring practical programming skills in the high-level language C **++**  **LEARNING OUTCOMES:**  **Bachelors know**:  - the main stages of software development;  -basic principles of structural and object-oriented programming technology;  - basic principles of debugging and testing of software products;  - methods and means of technical documentation development.  **are able**:  - to carry out the development of the program module code in the C++ programming language;  - to develop an algorithm for the task and implement it using C++ tools;  - to apply mathematical methods for solving automation problems;  - to perform testing and debugging of the program at the module level.  **COMPETENCES:**  - to use deep theoretical and practical knowledge in the field of software development, mathematical, algorithmic support;  - to demonstrate proficiency methods of using tools at the developing stages of a software product;  - to demonstrate skills in using tools to automate the preparation of software documentation. |
| **Content** | The use of arrays in the organization of sorting algorithms without optimization and with optimization. Structures and associations, files. A function use when working with complex data types. Pointers and links. Dynamic memory allocation. Principles and key idea of object-oriented programming. Classes, objects. Encapsulation, polymorphism, inheritance. Typical mathematical problems arising in the modeling of engineering problems. |
| **Current control** | Calculation and graphic works -1,2,3 Midterm control 1,2 tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, Software |
| **References** | 1. Anisimov, A.E. Sbornik zadanij po osnovaniyam programmirovaniya.- M.: Internet Un-t Inform. Texnologij, 2014: Binom.  2. Seiketov, A. Algorithms, Data Structures and Programming: textbook. - Almaty : BookPrint, 2016.  3. Agal`czov V.P., Matematicheskie metody` v programmirovanii : uchebnik / V.P. Agal`czov. - 2-e izd. pererab. i dop. - M. : FORUM, 2021: INFRA-M.  4. Gagarina L.G., Vvedenie v teoriyu algoritmicheskix yazy`kov i kompilyatorov : ucheb. posobie / L.G. Gagarina, E.V. Kokoreva. - M. : ID FORUM, 2020.  5. Chernikov B.V., Ocenka kachestva programmnogo obespecheniya : praktikum:ucheb.posobie / B.V. Chernikov, B.E. Poklonov. - M. : ID FORUM-INFRA-M, 2020. |

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| **Module name** | **MAC-B11 - Module of socio-political knowledge (political science, sociology)** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor AUES, associate professor Mukhambedyarova Altynai Tuleuovna (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Variable with "Philosophy" |
| **Teaching methods** | Lectures, practical seminars,  Bachelor’s self-study work under teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  Class hours:  Lectures -30; practice -15; SSW - 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Modern history of Kazakhstan |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to provide students with scientifically based objective knowledge of sociology, as well as to contribute to the formation of the ability to understand the social mechanisms of society functioning, 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**:  -explain the nature of situations in various spheres of social communication based on the content of theories and ideas of 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 Kazakh society;  - develop programs for resolving conflict situations in society, including in professional society;  -correctly express and argumentatively defend their own opinion on issues of social significance.  **COMPETENCES**:  have an idea about:  - objective prerequisites for the emergence and formation of sociological knowledge  - the structure, laws, principles, and mechanisms of development of society  - types and rules of conducting sociological research  - the place and role of sociology in the transformation and democratization of modern society  - theoretical and applied foundations and patterns of functioning of sociological science;  - basic sociological concepts;  - classical and modern sociological theories;  - the main directions and results of modern research in the field of sociology.  **be able to:**  - independently analyze the processes and phenomena occurring in society;  - correctly and argumentatively formulate your thoughts orally and in writing;  - use the acquired titles in specific situations;  - dynamically use alternative, new and/or innovative sociological approaches to solving professional tasks:  - essays, presentations, glossary, statistical report, etc. |
| **Content** | The research of social and political institutions, movements, value orientations regulating the behavior of the individual is presented.  The rationalistic, reasonable nature of sociology and political science invariably opposes irrational tendencies, social chaos and anomie present in any society.  The common sense and sense of realism of sociology and political science in the process of modernization of society are studied. |
| **Current control** | Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Biekenov K.U., Biekenova S.K., Kenzhakimova G.A. "Sociology: Textbook". - Almaty: Evero, 2016. - 584s.  2.Abdirayymova G.S. "Zhastarsociologiyasy": okukuraly. 2- basylym. - Almaty: "Kazakuniversiteti", 2012. - 224s.  3.Grushin B.A. "Opinions about the world and the world of opinions". M.: Praxis, VTsIOM, 2011.  4."Sociology. Fundamentals of General Theory: Textbook" / Edited by G.V. Osipov, L.N. Moskvichev.  - 2nd ed., ispr. and add. - M.: Norm, 2015. - 912 p.  6. J. Ritzer, J. Stepnicki. "Aleumettanuteories". - Almaty: "Ulttykaudarmaburosy" kogamdykkory, 2018. - 856 p.  7. The message of the Head of State Kassym-Jomart Tokayev to the people of Kazakhstan THE UNITY OF THE PEOPLE AND SYSTEMIC REFORMS IS A SOLID FOUNDATION FOR THE PROSPERITY OF THE COUNTRY // https://www.akorda.kz/ru/poslanie-glavy-gosudarstva - kasym-zhomarta-tokaeva-narodu-kazahstana-183048  8. Chebotarev A.E. Political thought of sovereign Kazakhstan: dynamics, ideas, assessments. Almaty: IMEP at the Foundation of the First President, 2015.  9. Grinin L. E. The State and the historical process. Political cross-section of the historical process.- M.: Librocom, 2014. |

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| **Module name** | **MAC-B12-1 - Mathematical basis of automation** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor, Cand.Tech.Sc. Ibrayeva Lida Kuandykovna (kaz. rus.) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Mathematical Methods in Automation issues» |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15; Laboratory classes - 15; practical seminars – 15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 1, Mathematics 2 |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** knowledge expansion and deepening of the sections of mathematics used in solving automation and control problems; acquisition of skills in use of computer systems for the control algorithms development and implementation.  **LEARNING OUTCOMES:** to form students' knowledge of sections of higher mathematics necessary to solve engineering problems in the field of automation and control.  **Bachelors**  **know:**  **-** theoretical description of simple automation problems;  - application of differential equations for modeling of control objects;  - methods to describe physical phenomena using abstract models with basic concepts of probability theory use;  - mathematical methods of systematization, processing and use of statistical data for scientific and practical conclusions;  **Are able to:**  - apply mathematical methods of numerical analysis to solve applied problems;  - solve linear differential and difference equations by analytical and numerical methods;  - apply the operator method for solving linear differential equations;  - solve nonlinear differential equations;  - obtain the matrix form of systems of differential equations;  - be able to analyze patterns of mass homogeneous random phenomena by methods of probability theory;  - to perform processing and statistical analysis of data for solving control and prediction problems in the presence of randomness;  - apply modern software tools for solving applied automation problems.  **COMPETENCES:**  - Demonstrate proficiency in higher mathematics for solving engineering problems in the field of automation and control;  - Demonstrate skills in finding relationships between the studied facts, phenomena, theories in the field of natural sciences;  - master the methods of processing the results of statistical research;  - master modern computer technologies and software. |
| **Content** | Formalization of representations in the field of basic mathematical description of automatic control systems. Fractional-rational functions of a complex variable, impulse functions, Fourier and Laplace transforms, operator method of solution of differential equations, linear algebra. Solution of theoretical and practical problems associated with obtaining a mathematical description, modeling, analysis, design, testing and operation of modern control systems. |
| **Current control** | Calculation and graphic works- 1,2,3, Midterm control 1,2, tests. |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, Software, laboratory base. |
| **References** | 1. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 2. Куралбаев, З.К. Математическое и компьютерное моделирование: учеб.пособие. Ч.1 / З.К. Куралбаев; МОН РК, НАО АУЭС. - Алматы : Ак-Шагыл, 2017. - 442с 3. Шипачев, В.С. Высшая математика. Полный курс [Текст]: учебник для академического бакалавриата / В.С. Шипачев; под. ред. А.Н. Тихонова. - 4-е изд., испр. и доп. - М : Юрайт, 2015. 4. Гмурман В.Е.Теория вероятности и математическая статистика-М. ,2013 5. Григорьев-Голубев, В.В. Теоория вероятностей и математическая статистика. Руководство по решению задач.- СПб.: БХВ-Петербург, 2014.- 256с 6. Спирина М.С. Теория вероятности и математическая статистика-М.: «Академия»,2013 7. Сидняев Н.И. Теория вероятности и математическая статистика.-М.: «Юрайт»,2011 8. <https://lpsa.swarthmore.edu/LaplaceXform/FwdLaplace/LaplaceDiffEq.html> 9. <http://www.unn.ru/books/met_files/Laplace%20transform.pdf>   10. <https://www.mathworks.com/products/matlab-online.html> |

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| **Module name** | **MAC-B12-2 - Mathematical Methods in Automation issues** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor, Cand.Tech.Sc. Ibrayeva Lida Kuandykovna (kaz. rus.) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Mathematical basis of Automation» |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Bachelor’s self-study work under teacher’s supervision |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15; Laboratory classes - 15; practical seminars – 15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 1, Mathematics 2. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to provide students with in-depth knowledge of the theory of linear differential equations; to teach the methods of probability theory and mathematical statistics needed to solve automation problems**.**  **LEARNING OUTCOMES:**  **Bachelors**  **know:**  **-** theoretical methods of describing automation problems  - application of mathematical methods to solve automation problems  - basic concepts of functions of a complex variable  - basics of probability theory and mathematical statistics  - modern software for solving applied problems  **Are able to:**  - apply the theory of differential equations of various orders to describe control objects  - apply analytical and numerical methods for solving systems of differential equations  - use Laplace transform to solve linear differential equations of different orders  - process the results of experiment  - perform statistical data analysis.  **COMPETENCES:**  - demonstrate the theory knowledge of linear differential equations  - know investigation methods of the simplest mathematical models of control objects  - master the of mathematical statistics methods  - demonstrate skills in application of modern software for automation problems solution. |
| **Content** | System approach to the control systems design and data processing. Solution of theoretical and practical problems related to obtaining mathematical description, modeling, analysis, design, testing and operation of modern control systems. Solution of difference equations based on discrete Laplace transform and Z-transformation. Application of mathematical methods to investigate a variety of control problems. |
| **Current control** | Calculation and graphic works- 1,2,3, Midterm control 1,2, tests. |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, Software, laboratory base. |
| **References** | 1. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 2. Куралбаев, З.К. Математическое и компьютерное моделирование: учеб.пособие. Ч.1 / З.К. Куралбаев; МОН РК, НАО АУЭС. - Алматы : Ак-Шагыл, 2017. - 442с 3. Гмурман В.Е.Теория вероятности и математическая статистика-М. ,2013 4. Григорьев-Голубев, В.В. Теоория вероятностей и математическая статистика. Руководство по решению задач.- СПб.: БХВ-Петербург, 2014.- 256с 5. Спирина М.С. Теория вероятности и математическая статистика-М.: «Академия»,2013 6. Сидняев Н.И. Теория вероятности и математическая статистика.-М.: «Юрайт»,2011 7. <https://www.matburo.ru> 8. <http://www.math24.ru> 9. <http://www.cleverstudents.ru/differential_equations/differential_equations.html> |

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| **Module name** | **MAC-B13 - Theoretical basis of electrical engineering** |
| **Semester(s), in which the module is taught** | 3 |
| **Person, responsible for the module** | Boldyreva Lyubov Pavlovna (Russian language)  Arshabekova Alma Tulendievna (Kazakh)  Baimaganov Aliskar Sainovich (English) |
| **Language** | Kazakh, Russian, English |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, University component |
| **Teaching methods** | lectures, laboratory works, course project, self- study work of a Bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **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 pre-requisites for joining the module** | Mathematics 1 Mathematics 2  Physics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To study steady state and transient processes in linear electrical circuits. The course also contains the general theory of linear and nonlinear circuits and engineering methods of their calculation and analysis. **LEARNING OUTCOMES: Bachelor’s students know: -** methods for calculation of electrical circuits of direct, sinusoidal and non-sinusoidal current; - methods for calculating three-phase circuits; - basic methods for calculating transient processes in electric circuits; - basic laws of electromagnetic field theory; - calculation of magnetic circuits. **Are able to:** - apply classical, operator and spectral methods of calculation of transients and Duhamel integral. - conduct experiments, work with instrumentation, calculation and processing of results. **Competences:** - Ability to perform calculations of steady state and transient modes; - analyze reference and normative literature, draw up technical documentation; - Demonstrate skills in developing technical support for devices. |
| **Content** | DC and sinusoidal current circuits. Modes in three-phase circuits. Transient processes in electrical circuits. Ohm's and Kirchhoff's laws. Calculation of DC, sinusoidal, non-sinusoidal current circuits, classical, operator and spectral methods of calculation of transients and Duhamel integral. Basic laws of electromagnetic field theory. Calculation of magnetic circuits. |
| **Current control** | Course paper, mid-term control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | **Facilities for successful module implementation:**  Personal computer, software, laboratory equipment |
| **References** | **Basic refereces:**   1. С. Ю. Креслина, А. Т. Аршабекова. Теоретические основы электротехники. Методические указания и задания по выполнению лабораторных работ для специальности 5В070200 – Автоматизация и управление. – Алматы: АУЭС, 2014. – 34 с. 2. С. Ю. Креслина, А. Т. Аршабекова. Теоретические основы электротехники. Методические указания и задания к курсовой работе для студентов специальности 5В070200 – Автоматизация и управление. – Алматы: АУЭС, 2013. – 12 с. 3. Бессонов Л. А. Теоретические основы электротехники. – М.: Гардарики, 2013. – 638 с. 4. Аршидинов, М.М. Электротехниканың теориялық негіздері. Электр тізбектері мен электромагнитті өрістерді есептеу мысалдары: оқу құралы. - Алматы : АЭжБУ, 2017. - 94б 5. Алиев И.И., Электротехника и электрооборудование : в 3 ч.: учеб. пособие. Ч.1 / И.И. Алиев. - 2-е изд., испр. и доп. - М. : Юрайт, 2020. - 374 с. - (Высшее образование) 6. Ермағанбетов Қ.Т., Электртехника және электроника негіздері : оқулық. 2-т. / Қ.Т. Ермағанбетов. - Алматы : ЭВЕРО, 2021. - 156 б 7. Казахстанская национальная электронная библиотека <http://kazneb.kz/> 8. Online курсы<https://www.coursera.org/> 9. Бесплатные онлайн-курсы от 140 ведущих университетов мира <https://www.edx.org/> 10. Тренажёр для подготовки к ЕНТ, итоговой аттестации и ВОУД <https://itest.kz/> 11. Библиографическая и реферативная база данных <https://www.elsevier.com/>, <https://www.elsevier.com/solutions/scopus> 12. Независимая от издателей глобальная база данных о цитировании публикаций и исследовательская аналитическая платформа <https://clarivate.com/webofsciencegroup/solutions/web-of-science/> 13. 7 Национальный открытый Университет России «ИНТУИТ» <https://www.intuit.ru/> |

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| **Module name** | **MAС-B14-1 - Advanced Physics** |
| **Semester(s), in which the module is taught** | 3 |
| **Person, responsible for the module** | Kaz Nysanbaeva S.K.  Rus Akhmetkaliev R.B.  Eng Salamatina A.M. |
| **Language** |  |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective "Special questions of physics" |
| **Teaching methods** | lectures, laboratory works, calculation graphic works 1,2, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Mathematics 1 Mathematics 2  Physics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of students' abilities and skills to use methods of physical research to solve theoretical and experimental-practical training problems; formation of students' skills of independent cognitive activity;  **LEARNING OUTCOMES:**  **Bachelor's students know:** - physical and worldview interpretations of classical and modern physics; **are able to:** - model physical situations using a computer; - carry out physical experiments, work with measuring instruments, calculation and processing of the received data.  **Competences: -** students can conduct experimental research of physical phenomena, helping to solve specific problems in professional activity; - can reconstruct their thinking to the perception of inevitable transformations of old scientific and technical notions into fundamentally new ones; - can systematize and structure the obtained results of activity; - can analyze and evaluate the results of activity; |
| **Content** | The following sections are studied: electrodynamics, oscillations and waves, the basics of quantum mechanics, the structure of the atom, forming the skills of independent cognitive activity, experimental research of physical phenomena, helping to solve specific problems in professional activities, modeling physical situations using a computer, working with measuring instruments. |
| **Current control** | Control work, test, mid-term control, SSW, CGW, SSTS |
| **Final control** | Examination |
| **Study and examination requirements** | **Facilities for successful module implementation:**  Personal computer, software, laboratory equipment. |
| **References** | 1. Савельев И.В. Курс общей физики: в 4-х т.:учеб.пособие для вузов. Кронус,2012. 2. Чертов А.Г., Воробьев А.А. Задачник по физике.-М.: Высш. шк. , 2009. 3. Иродов И.Е. Задачи по общей физике.-М.: Бином., 2012. 4. 6. Иродов И.Е. Электромагнетизм. Основные законы. М.: Бином, 2014. 5. Физика. Задания к практическим занятиям/ под ред. Лагутиной Ж.П. – Минск: Выш. шк., 1989. 6. Волновая оптика. Методические указания к выполнению лабораторных работ для студентов всех форм обучения всех специальностей. - Алматы: АУЭС, 2010.   7. Квантовая физика. Методические указания к выполнению лабораторных работ для студентов всех специальностей. - Алматы: АУЭС, 2015 |

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| **Module name** | **MAC-B14-2 - Special issues of Physics** |
| **Semester(s), in which the module is taught** | 3 |
| **Person, responsible for the module** | Kaz Syzdykova R.N.  Rus Mazhitova L.H.  Eng Salamatina A.M. |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with “Advanced Physics” |
| **Teaching methods** | lecture, laboratory works, calculation graphic work 1,2, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Mathematics 1,2, Physics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To form students' abilities and skills to use fundamental laws, theories of classical and modern physics, as well as methods of physical research to solve theoretical and experimental-practical training problems from various fields of physics;  **LEARNING OUTCOMES:**  **Bachelor's students know: -** modern physical theories and principles, physical research methods, basic laws, and the limits of their applicability; **are able to: -** apply theoretical knowledge to solve specific physical problems and situations, analyze the results of a physical experiment; - model physical situations using a computer; **Competences:** - demonstrate skills in the use of fundamental laws, theories of classical and modern physics; - can conduct experimental scientific research of physical phenomena, helping to solve specific problems in professional activity; - can analyze and evaluate the results of activities; - can change subject actions into practical ones; |
| **Content** | Nonlinear oscillator, self-oscillation, relaxation self-oscillation. Acoustic waves, characteristics of acoustic waves and relationship between them; reflection and refraction of acoustic waves. Dipole electromagnetic radiation. Doppler effect for electromagnetic waves. Elements of nonlinear optics. Electromagnetic waveguides. Probability in quantum theory; stationary and non-stationary Schrödinger equation; over-barrier propagation. Principle of quantum oscillator operation; applications of quantum electronics. |
| **Current control** | Control work, test, mid-term control, SSW, CGW, SSTS |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Савельев И.В. Курс общей физики.- М.: Кнорус, 2012. - т. 2.  2. Савельев И.В. Курс общей физики.- М.: Кнорус, 2012. - т.5  3. Детлаф А.А. , Яворский Б.М. Курс физики. - М. : Высш. шк., 2002  4. Трофимова Т.И. Курс физики. - М. : Высш. шк., 2004  5. Колебания. Методические указания к выполнению лабораторных работ для студентов всех форм обучения всех специальностей. - Алматы: АУЭС, 2015  6. Волновая оптика. Методические указания к выполнению лабораторных работ для студентов всех форм обучения всех специальностей. - Алматы: АУЭС, 2010.  7. Квантовая физика. Методические указания к выполнению лабораторных работ для студентов всех специальностей. - Алматы: АУЭС, 2015  8. Электромагнетизм. Методические указания к лабораторным работам. Лабораторный практикум с использованием компьютера. - Алматы: АУЭС, 2012  9. Чертов А.Г., Воробьев А.А. Задачник по физике.- М.: Высш. шк., 2006  10. Волькенштейн В.С. Сборник задач по общему курсу физики. – СПб. Книжный мир, 2003. |

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| **Module name** | **MAС-B15-1 - Basics of collecting and transmitting information** |
| **Semester(s), in which the module is taught** | 3 |
| **Person, responsible for the module** | Associate Professor, Candidate of Technical Sciences Sagyndykova Sholpan Nazarovna (Kazakh lang.)  Senior Lecturer, MSc Vodolazkina Natalia Aleksandrovna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Physics, Mathematics 1, Mathematics 2 |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to obtain theoretical and practical knowledge of the methods and means of collecting and transmitting information, mastering the principles of building systems for the accumulation and transmission of information. **LEARNING OUTCOMES: Bachelor's students know:**  - types and methods of storing, measuring, processing, transmitting, compressing information, - basic methods of signal conversion; **are able to:** - calculate the parameters of information processing systems;  **Competences:** - use deep theoretical and practical knowledge in the field of creation of automated control systems of complex technological processes, carried out with the use of information systems of data collection and computing complexes; - Demonstrate proficiency in information collection and transfer methods. |
| **Content** | Methods of collecting, transmitting and processing information in the development of information and control systems. Principles of digital signal processing, design of data acquisition systems. The construction of models of the process of identifying information. Technical means of information collection and transmission systems in automated systems. Modeling of data transmission systems. The use of the programming environment MatLab and LabView for recording, processing and displaying signals. |
| **Current control** | Calculation graphic works 1,2,3, mid-term control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Лебедько, Е.Г.Теоретические основы передачи информации [Текст]: учеб. пособие / Е.Г. Лебедько.- СПб.: Лань, 2011.- 352с.: ил. 2. Литвинская, О.С.Основы теории передачи информации [Текст]: учеб.пособие / О.С. Литвинская, Н.И. Чернышёв.- М.: КноРус, 2010.- 168с 3. Панин, В.В. Основы теории информации: учебное пособие для вузов. - 3-е изд.,испр. - М. : БИНОМ. Лаб.знаний, 2012. - 438с 4. Гвоздева В.А., Информатика, автоматизированные информационные технологии и системы : учебник / В.А. Гвоздева. - М. : ФОРУМ: ИНФРА-М, 2021. - 542с. - (Высш.образование. Бака-лавриат)   Панин, В.В. Ақпараттық теориясы негіздері : оқулық. - Алматы : Prіnt-S, 2012. - 460б |

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| **Module name** | **MAС-B16-1 - Database Design** |
| **Semester(s), in which the module is taught** | 3 |
| **Person, responsible for the module** | Associate Professor, candidate of technical sciences, Sauanova Klara Tagaevna (Kazakh lang.)  Senior Lecturer, MSc Vodolazkina Natalia Aleksandrovna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Database Management Systems" |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology. Algorithms and data structures. C++ programming technologies in automation issues / Software implementation of engineering problems in C++ |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of a set of students professional qualities, the study of the basics of database design, data bank components, characteristics and technologies of organization of modern databases. **LEARNING OUTCOMES:**  **Bachelor’s students know:**  - data models, principles of database design;  - types of databases and their design methods;  - types of information systems created on the basis of modern DBMSs;  - trends in the development of modern database design tools;  - levels of data representation, normal forms of relationship schemes;  - SQL query language commands;  - basics of implementation technologies in DBMS environments.  **Are able to:**  - use methods and tools in database design;  - build models of the subject area;  - organize data entry into the database;  - form queries and perform data processing with the help of SQL query language commands to a relational database and receive result documents.  **Competences:**  - ability to install, configure, administer DBMS, collect, interpret meaningful data in the field of automation;  - ability to apply software, mathematical, algorithmic, information and other support for industrial database management systems;  - Demonstrate the ability to design and program data management systems using modern database design technologies;  - analyze reference and regulatory literature, and design technical documentation. |
| **Content** | Principles of database design. Database architectures. Data models in modern database management systems. Tools for developing a database schema, application development. Transaction management, database protection. |
| **Current control** | Calculation graphic works 1,2,3, mid-term control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Агальцов В.П., Базы данных : в 2 кн.: учебник. Кн. 1: Локальные базы данных / В.П. Агальцов. - 2-е изд., перераб. - М. : ФОРУМ, 2021: ИНФРА-М. - 352 с. - (Высшее образование) 2. Агальцов В.П., Базы данных : в 2 кн. : учебник. Кн. 2: Распределенные и удаленные базы данных / В.П. Агальцов. - 2-е изд., перераб. - М. : ФОРУМ, 2021: ИНФРА-М. - 271 с. - (Высшее образование: Бакалавриат) 3. Волк В. К., Базы данных. Проектирование, программирование, управление и администрирование : учебник / В.К. Волк. - 2-е изд., стер. - СПб. : Лань, 2021. - 244 с. - (Высшее образование) 4. Мартишин С.А., Базы данных. Практическое применение СУБД SQL и NoSQL- типа для проектирования информационных систем : учеб. пособие / С.А. Мартишин, В.Л. Симонов, М.В. Храпченко. - М : ИНФРА-М, 2021: ФОРУМ. - 368 с. - (Высшее образование: Бакалавриат) 5. Сатимова, Е.Г. Проектирование баз данных: учеб.пособие; МОиН РК, НАО АУЭС. - Алматы: АУЭС, 2016. - 126с; 8,0 у.-и.л.   Шустова Л.И., Базы данных : учебник / Л.И. Шустова, О.В. Тараканов. - М : Инфра-М, 2021. - 304 с. - (Высшее образование: Бакалавриат) |

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| **Module name** | **MAC-B16-2 - Database Management Systems** |
| **Semester(s), in which the module is taught** | 3 |
| **Person, responsible for the module** | Associate Professor, candidate of technical sciences, Sauanova Klara Tagaevna (Kazakh lang.)  Senior Lecturer, MSc Vodolazkina Natalia Aleksandrovna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Database Design" |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology. Algorithms and data structures. C++ programming technologies in automation issues / Software implementation of engineering problems in C++ |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation in students of a set of professional qualities, providing a solution to the problems associated with the use and design of databases under the control of modern database management systems (DBMS).  **LEARNING OUTCOMES:**  **Bachelor’s students know:**  - use deep theoretical and practical knowledge of data models;  - the main functions of DBMSs in modern IS;  - types of information systems created on the basis of  modern DBMS  know how to:  - Demonstrate proficiency in data processing methods and tools;  -demonstrate skills in designing relational databases  data;  - form SQL queries to a relational database  **Competences:**  Collect and interpret meaningful data in the field of automation for solving the problems;  - Demonstrate ability to design and program data management systems;  - Demonstrate proficiency in the use of reference and regulatory literature and design of technical documentation. |
| **Content** | Information and data, query processing in a data bank, languages used in a data bank, data model selection, relational data model, query languages SQL and QBE, database life cycle, stages and automated database design, classification of DBMS, relational DBMS, object-oriented DBMS, client-server architecture DBMS, database development trends. |
| **Current control** | Calculation graphic works 1,2,3, mid-term control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Агальцов В.П., Базы данных : в 2 кн.: учебник. Кн. 1: Локальные базы данных / В.П. Агальцов. - 2-е изд., перераб. - М. : ФОРУМ, 2021: ИНФРА-М. - 352 с. - (Высшее образование) 2. Агальцов В.П., Базы данных : в 2 кн. : учебник. Кн. 2: Распределенные и удаленные базы данных / В.П. Агальцов. - 2-е изд., перераб. - М. : ФОРУМ, 2021: ИНФРА-М. - 271 с. - (Высшее образование: Бакалавриат) 3. Полищук Ю.В., Базы данных и их безопасность : учеб. пособие / Ю.В. Полищук, А.С. Боровский. - М : ИНФРА-М, 2020. - 212 с. - (Высшее образование - Специалитет) 4. Шустова Л.И., Базы данных : учебник / Л.И. Шустова, О.В. Тараканов. - М : Инфра-М, 2021. - 304 с. - (Высшее образование: Бакалавриат) 5. Утепбергенов, И.Т. Базы данных в информационных системах : учебник / И.Т. Утепбергенов, А.Д. Хомоненко. - Алматы : Экономика, 2013. - 540с   Утепбергенов, И.Т. Ақпараттық жүйелердегі деректер қоры: оқу құралы / И.Т. Утепбергенов, Ш.Н. Сагындыкова; ҚРБжҒМ. - Алматы : АЭжБУ, 2016. - 160б |

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| **Module name** | **MAС-B17 - Philosophy** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | Kaz Mukhamedjan Kuanysh Shakirtovich  Rus Abrahmatova Gulnara Abraikulovna  Eng Abrahmatova Gulnara Abraikulovna |
| **Language** | Kaz/Rus/Eng |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  **Compulsory** |
| **Teaching methods** | lecture, seminars, course papers, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; practical classes -30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Modern History of Kazakhstan,  Module of socio-political knowledge (political science, sociology) |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of students' basic system of philosophical knowledge, development of philosophical way of thinking about the general picture of the world, complex interconnections of life reality, the values of human existence, mastering the principles of rational philosophical approach to the processes and trends of modern information society  **LEARNING OUTCOMES:**  **Bachelor’s students know:**  - the main directions of philosophical thought;  - dialectics of formation of a personality, its freedom and responsibility, originality of intellectual, moral and aesthetic experience of different historical epochs  **Are able to:**  **-** justify the worldview as a product of philosophical comprehension and study of the natural and social world;  - justify the role and meaning of the key worldview concepts as values of social and personal existence of a human being in the modern world;  **Competences:**  - demonstrate research skills relevant to identifying the philosophical content of problems in the professional field and present the results for discussion;  - ability to formulate and competently argue own moral position in relation to actual problems of modern global society. |
| **Content** | The discipline aims at developing an open mind, understanding of one's own national code and national identity, spiritual modernization, competitiveness, realism and pragmatism, independent critical thinking, the cult of knowledge and education, mastering such key worldview concepts as justice, dignity and freedom, and developing and strengthening the values of tolerance, intercultural dialogue and culture of peace. |
| **Current control** | Presentation, essay, midterm control, essay, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. Adherence to course policy |
| **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 https://openu.kz/ru/courses/filter?sortBy=DATE&categories[]=2 |

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| **Module name** | **MAС-B18-1 - Metrology, Standardization, Certification and Quality Management** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | Senior Lecturer, MSc Zhanna Serikbayevna Tleubaeva (Kazakh lang)  Professor, Candidate of Technical Sciences Khan Svetlana Gurievna (Russian lang) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Metrology and Measurements" |
| **Teaching methods** | lecture, laboratory works, course project, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **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 pre-requisites for joining the module** | Mathematics 1, 2; Mathematical basis of Automation/Mathematical Methods in Automation issues; Information and Communication Technology; Physics; Theoretical basis of electrical engineering. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of a minimum of knowledge in the field of standardization, certification and metrology, allowing in the future the young specialist to improve, independently make technical decisions at the international, regional and national levels, and also skills of application of methods and practical bases of course at designing of the equipment and devices, calculation of errors of measuring instruments, total errors of measuring channels; development of standards and calculation of their efficiency.  **LEARNING OUTCOMES:**  **Bachelor’s students know:**  **-** methods of practical organization and carrying out works on standardization, certification and quality management; classification of types and methods of measurements; basic metrological characteristics of measuring instruments; classification of errors of measurements and measuring instruments; methods of measurement results processing;  - know how: to address and apply in practice standards and other normative documents; competently conduct measurements and calculate measurement errors; correctly perform processing of single and multiple measurements;  **Competences:**  Demonstrate experience in the practical application of standards: GSI, GSS, ESDP, ESCD and other normative documents, to be guided by them when solving technical issues of production.  Demonstrate a clear understanding of the unity of measurements and basic concepts of the theory of errors. |
| **Content** | State system for ensuring the uniformity of measurements (GSI). Classification of measurements and measurement methods. Theory and methods of calculation of errors of direct and indirect measurements. Basics of technical regulation. Standardization and its role in the development of technology and quality management of products. Certification and quality management. Quality indicators, their properties and rules of formation. Processing of expert evaluations of product quality. |
| **Current control** | Course paper, mid-term control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Ананьева Т.Н., Стандартизация, сертификация и управление качеством программного обеспечения : учеб. пособие / Т.Н. Ананьева, Н.Г. Новикова, Г.Н. Исаев. - М. : ИНФРА-М, 2019. - 232 с. - (Высш.образование. Бакалавриат) 2. Грибанов, Д.Д. Основы метрологии, сертификации и стандартизации : учеб.пособие. - М. : ИНФРА-М, 2015. - 127с. 3. Радкевич, Я.М. Метрология, стандартизация и сертификация: учебник. Т.1. - 5 изд., перераб. и доп. - М. : Юрайт, 2014. - 234с. 4. Радкевич, Я.М. Метрология, стандартизация и сертификация: учебник. Т.2. - 5 изд., перераб. и доп. - М. : Юрайт, 2014. - 597с. 5. Хан, С. Г. Метрология, стандартизация и сертификация и управление качеством [Текст] : учеб.пособие / С.Г. Хан; МОН РК, НАО АУЭС. - Алматы : АУЭС, 2018. - 119 б.: 7,4 есеп.-б.т. 6. Метрология, стандартизация, сертификация и управление качеством: Конспект лекций/ сост. С.Г. Хан. - Алматы : АУЭС, 2015. - 58с 7. Хан, С. Г. Метрология, стандарттау, сертификаттау және сапаны басқару [Мәтін] : оқу құралы / С.Г. Хан, Л.К. Ибраева; ҚР БжҒМ; КЕАҚ АЭжБУ. - Алматы : АЭжБУ, 2018. - 118 б.: 7,3 есеп.-б.т.   Метрология, стандарттау, сертификаттау және сапаны басқару: дәрістер жинағы /құраст.: С.Г. Хан, Л.К. Ибраева. - Алматы : АЭжБУ, 2016. - 56б |

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| **Module name** | **MAС-B18-2 - Metrology and Measurements** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | Senior Lecturer, MSc Zhanna Serikbayevna Tleubaeva (Kazakh lang)  Professor, Candidate of Technical Sciences Khan Svetlana Gurievna (Russian lang) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Electice with “Metrology, standardization, certification and quality management” |
| **Teaching methods** | lecture, laboratory works, course project, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **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 pre-requisites for joining the module** | Mathematics 1, 2; Mathematical basis of Automation/Mathematical Methods in Automation issues; Information and Communication Technology; Physics; Theoretical basis of electrical engineering. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to acquaint students with the basic concepts and provisions of metrology, operating principles, properties and characteristics of common measuring instruments of various physical quantities; as well as to form skills in applying methods and practical basics of the course in designing equipment and instruments, calculating errors of measuring instruments, total errors of measuring channels.  **LEARNING OUTCOMES:**  **Bachelor’s students know:** basic concepts of metrology, systems of physical quantities and methods of their reproduction with subsequent transfer to working measuring instruments; methods and measuring instruments of different physical quantities, their characteristics and operating principles; classification of measurement errors and measuring instruments; methods of measurement results processing;  **are able: to** choose methods and means of measurement of various physical quantities; competently carry out measurements and calculate the errors of measurements; correctly carry out processing of single and multiple measurements;  **Competences:**  - Demonstrate a clear understanding of the basic concepts of metrology and uncertainty theory.  - Demonstrate experience in making measurements of physical quantities, parameters and indicators using modern measurement systems based on devices with built-in analog-to-digital converters (ADC) and microcontroller control. |
| **Content** | Basic types and methods of measurements Errors of measurements. Classification. Basic information about measuring instruments. Basic metrological characteristics of measuring instruments. Measurements of currents and voltages. Measuring instruments for currents and voltages. Measurements of power, energy and quantity of electricity. Measurement of frequency, time intervals, and phase. Measurements for direct current circuits. Measurement information systems. |
| **Current control** | Course paper, mid-term control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | **Facilities for successful module implementation:**  Personal computer, software, laboratory equipment |
| **References** | 1. Сергеев А.Г. Метрология,стандартизация и технические измерения.-М.: «Юрайт»,2012 2. Сергеев, В. Основы метрологии и средства измерения [Текст] : учебник / В. Сергеев , В. Юрченко; рек. МОиН РК. - 2-е изд., перераб. и доп. - Астана : Фолиант, 2016. - 192с. 3. С.Г. Хан. Метрология и измерения. (для студентов всех форм обучения специальности В5070200 - Автоматизация и управление).- Алматы: АУЭС, 2010.- 66 с. 4. Хан, С. Г. Метрология, стандартизация и сертификация и управление качеством [Текст] : учеб.пособие / С.Г. Хан; МОН РК, НАО АУЭС. - Алматы : АУЭС, 2018. - 119 б.: 7,4 есеп.-б.т. 5. Н.М.Айтжанов, С.Г. Хан. Метрология және өлшеу. 5В070200 – Автоматтандыру және басқару мамандығының студенттері үшін дәрістер жинағы– Алматы: АЭжБУ, 2012. – 66 б.   Хан, С. Г. Метрология, стандарттау, сертификаттау және сапаны басқару [Мәтін] : оқу құралы / С.Г. Хан, Л.К. Ибраева; ҚР БжҒМ; КЕАҚ АЭжБУ. - Алматы : АЭжБУ, 2018. - 118 б.: 7,3 есеп.-б.т. |

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| **Module name** | **MAС-B19 - Module of socio-political knowledge**  **(culturology, psychology)** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | Senior lecturer Abdieva Gaziza Ilyasovna (Russian language)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, University component |
| **Teaching methods** | lecture, seminars, course papers, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; practical classes -15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Modern History of Kazakhstan, Module of socio-political knowledge (political science, sociology) |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To teach students to orient in a variety of cultures, understanding of own as well as other cultures. Formation of the bases of cultural and psychological knowledge in the field of development of personal and professional competences of the future specialist. Formation of its individual-typological features, professional self-determination, providing use in the process of professional formation and development of a harmonious and successful personality.  **LEARNING OUTCOMES:**  **Bachelor’s students know:**  - classical and modern theories of societal development and the role of culture in society;  - new trends and directions, programs about the development of culture of their people and country;  - the basic theoretical concepts of the development of individual-typological features of personality in the process of professional activity;  - the content and specificity of professional communication, interpersonal communication and psychological impact within the chosen specialty;  **are able to:**  - independently analyze the processes and phenomena occurring in society;  - Analyze culture as a system of cultural phenomena, identifying the types of relationships between elements of culture  - effectively apply psychological methods, techniques and techniques of motivation and communication in personal and professional activity;  - skillfully use psychodiagnostic techniques for the study of individual-psychological features of specialists in the team.  **Competences:**  - to apply in professional activity the knowledge of theoretical bases of cultural studies and psychology;  - to use new trends and directions of culture in the development of individual-psychological features of personality for the successful implementation of professional activity of a specialist;  - apply psychological mechanisms for building effective professional communication and harmonious interaction with people in the team. |
| **Content** | The module of socio-political knowledge (Cultural studies and Psychology) consists in the formation of socio-humanitarian outlook of students in the context of solving problems of modernization of social consciousness.  Theoretical knowledge of this module is used in the professional activity of the individual, to guide students to the knowledge of cultural achievements of mankind, understanding and mastering the basic patterns and basic forms of development and formation of personal culture. This module will allow you to get psychological knowledge in the field of development of the future specialist's personality, the formation of its individual and typological features, the features of professional self-determination, as well as to get the ability to manage technology 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** | Personal computer, cases, mental maps, thesis notes. |
| **References** | 1. Абдиева Г.И. Психолого-педагогические особенности социализации личности в юношеском возрасте. Алматы «Қазақ университеті» 2020 2. Абдиева Г.И. Учебное пособие «Психология и педагогика». Алматы «Қазақ университеті» 2021 3. Zekrist R. I., Sociology and Political Science of Society Industry 4.0 : educational and methodological manual for students / R.I. Zekrist; MES RK. - Almaty, 2019. - 344 p. 4. Ғабитов Т.Х. «Қазақ мәдениетінің тарихы: оқу құралы». – Алматы: Қазақ университеті, 2016. 5. Жолдубаева А.К. «Культурология: практикум». - Алматы: Казну им.аль-Фараби, 2014. 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.   Құнанбаева М.Н. Основы психологиической сaморегуляции: учебное пособие. А.: Қазақ университеті, 2017. |

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| **Module name** | **MAС-B20 -** **Electronics** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | PhD, Associate Professor Orazalieva Sandugash Kudaibergenovna (Kazakh, Russian lang.) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective |
| **Teaching methods** | lecture, laboratory works, course papers, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mathematics 1, Mathematics 2, Physics, Advanced Physics/Special issues of Physics, Theoretical basis of electrical engineering |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** tostudy the element base, operating principles, methods of calculation and design of electronic devices.  **LEARNING OUTCOMES:**  **Bachelor’s students know:**  - the principle of operation and design features of electronic devices;  - physical phenomena occurring in electronic devices;  - the fields of application of various electronic devices;  - the main characteristics of electronic devices;  **are able to:**  - experimentally determine the parameters and characteristics of electronic appliances and devices  - make measurements of electric quantities in semiconductor devices;  - to make a preliminary calculation of parameters and a choice of the basic elements of an electronic circuit;  **Competences:**  - To demonstrate proficiency in modern and promising directions of electronics development;  - Have an ability to apply knowledge of electronics to solve engineering problems in the field of automation and control. |
| **Content** | Characteristics and properties of basic semiconductor devices, amplifiers. basic parameters of operational amplifier, linear and nonlinear circuits based on operational amplifiers, combinational (decoder, multiplexer, etc.) and sequential (trigger, registers, counters, etc.) logic circuits, synthesis of logic circuits. |
| **Current control** | Calculation graphic works 3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Ермағанбетов Қ.Т., Электртехника және электроника негіздері : оқулық. / Қ.Т. Ермағанбетов. - Алматы : ЭВЕРО, 2021. - 156 б 2. Электротехника және электроника негіздері: оқу құралы / Е.Ғ. Нәдіров, С.Б. Балабатыров, К.О. Ғали ж.б.; ҚР БжҒММ. - Алматы : Бастау, 2012. - 588б 3. Прянишников, В.А. Электроника: полный курс лекций. - 7-е изд. - СПб. : КОРОНА-Век, 2015. - 416c 4. Миловзоров, О.В. Основы электроники: учебник / О.В. Миловзоров, И.Г. Панков; Московский государственный машиностроительный ун-т (МАМИ). - 5-е изд.перераб.и доп. - М.: Юрайт, 2016. - 407с. - (Профессиональное образование) 5. Водовозов А.М., Основы электроники: учеб. пособие/А.М. Водовозов. - 2-е изд. - М : Инфра-Инженерия, 2019; Вологда. - 140 с. 6. Основы электроники [Текст]: Конспект лекций для бакалавров спец.5В071600 - Приборостроение / НАО АУЭС, Каф. электроники и робототехники, сост.: Г.К. Балбаев, А.А. Орынбай, А.Р. Фазылова.- Алматы: АУЭС, 2018.- 56 с 7. Электроника негіздері: 5В071600 - Аспап жасау маманд. бакалаврларына арн. дәрістер жиынтығы / Электроника және робототехника каф-сы, құраст.: Г.К. Балбаев, С.А. Юсупова, А.Р. Фазылова. - Алматы : АЭжБУ, 2018. - 55 б 8. Электроника. Оқу құралы .: Б.А. Жумагазин, А.Б. Нусибалиева, А.Б. - Алматы : АЭжБУ, 2021. - 121 б 9. Электроника. Учебное пособие .: Б.А. Жумагазин, А.Б. Нусибалиева, А.Б. - Алматы : АЭжБУ, 2021. - 188 с   Электроника. Зертханалық жұмысқа арналған әдістемелік нұсқаулықтар.: А.Б. Нусибалиева, А.Б. - Алматы : АЭжБУ, 2021. - 49 б |

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| **Module name** | **MAС-B21-1 - Elements and devices of automation** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | Senior Lecturer, MSc Shynar Kishikbayevna Adilova (Kazakh lang.)  Senior Lecturer, MSc Rudakova Larisa Nikolaevna (Russian lang.) |
| **Language** | Kazakh, Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Technical means of automation" |
| **Teaching methods** | lecture, laboratory works, course project, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Physics  Electronics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to study the basic elements of automation systems, microprocessor systems, to master the structural construction of microprocessor controllers.  **LEARNING OUTCOMES:**  Formation of students' knowledge and practical skills in the selection of measuring instruments and automation equipment, measuring technological parameters, adjustment and operation of elements and automation devices.  **Bachelor’s students know:**  - principles of design and functioning of serial technical and software-technical means of automation;  - structure and functionality of automation systems software;  - principles of construction and functioning of interfaces for local industrial control networks;  are able to:  - select technical and software and hardware means for creation of ACS and ACS;  - how to design automation equipment with specified characteristics using typical elements;  - design the layout of technical, software and hardware automation;  - operate technical, software and hardware automation.  **Competences:**  to use in-depth theoretical and practical knowledge in the selection of technical and software and hardware controls;  - to demonstrate the ability to set up and operate automation elements and devices. |
| **Content** | The structure of automatic and automated control systems of technological processes. Classification of automation equipment. Typification, unification and aggregation of automation equipment. Unified signals elements and devices. Sensors for measuring technological parameters. Converters. Types of actuators. DC and AC motors. Control bodies. Basics of microprocessor technology. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1.Ившин В.Л. Современная автоматика в системах управления технологическими процессами : учебник / В.Л. Ившин, М.Ю. Перухин. - М. : ИНФРА-М, 2020. - 402 с.  2. Шишмарёв В. Ю. Автоматика: учебник для СПО / В. Ю. Шишмарёв. — 2-е изд., испр. и доп. — М.: Издательство Юрайт, 2018. — 284 с.  3. Молдабаева М.Н. Контрольно-измерительные приборы и основы автоматики : учеб. пособие / М.Н. Молдабаева. - М. : Инфра-Инженерия, 2019. - 332 с.  4. Калиниченко А.В. Справочник инженера по контрольно-измерительным приборам и автоматике: учеб. пособие / А.В. Калиниченко, Н.В. Уваров, В.В. Дойников. - 4-е изд., испр. и доп. - М. : Инфра-Инженерия, 2020; Вологда: 580 с. - 580 с. - (Высшее образование: Бакалавриат)  5. Водовозов А.М. Микроконтроллеры для систем автоматики: учеб. пособие / А.М. Водовозов. - М. : Инфра-Инженерия, 2018. - 164 с.  6. Шишов О.В. Современные средства АСУ ТП : учебник / О.В. Шишов. - М. : Инфра-Инженерия; Вологда, 2021. - 532 с.  7. Федоров Ю. Н. Справочник инженера по АСУТП: проектирование и разработка: в 2 т.: учеб.-практ. пособие. Т.1 / Ю.Н. Федоров. - М. : Инфра-Инженерия, 2018; Вологда. - 448 с.  8. Федоров Ю. Н., Справочник инженера по АСУТП: проектирование и разработка: в 2 т.: учеб.-практ. пособие. Т.2 / Ю.Н. Федоров. - М. : Инфра-Инженерия, 2018; Вологда. - 484 с.  9. <https://www.sciencedirect.com/journal/engineering> |

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| **Module name** | **MAС-B21 – 2 - Technical Means of Automation** |
| **Semester(s), in which the module is taught** | 4 |
| **Person, responsible for the module** | Senior Lecturer, MSc Shynar Kishikbayevna Adilova (Kazakh lang.)  Senior Lecturer, MSc Larisa Rudakova (Russian lang) |
| **Language** |  |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Elements and devices of automation" |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Physics  Electronics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of students' knowledge and skills in the selection and operation of technical and software-technical means of automation of technological processes.  **LEARNING OUTCOMES:** Formation of students' knowledge and practical skills in choosing measuring instruments and technical means of automation, measuring technological parameters, performing adjustment and operation of elements and devices of automation.  **Bachelor’s students know:**  - trends in the development of technical means of automation, their classification;  - Typical technical means of automation and their areas of application;  - composition of technical means of typical automatic control systems and automated control systems;  - construction principles of the main nodes and implementation of the main types of functional transformations in technical means of automation;  - characteristics of actuators, automatic controllers and microprocessor controllers;  are able to:  - determine the static and dynamic characteristics of technical means of automation;  - evaluate the influence of parameters of information conversion devices and automatic controllers on the dynamics of automatic control systems  - choose technical and program-technical means for creating ACS and ACS;  - design automation equipment with specified characteristics using typical elements;  - design layout of technical, software and hardware automation equipment;  - operate technical, software and hardware automation.  **Competences:**  - to use deep theoretical and practical knowledge in the field of analysis of technical means of automatic control systems and automated control systems of technological processes;  - to demonstrate the ability of applying modern technical means for the implementation of given control algorithms. |
| **Content** | Typical structures of automated control systems of technological processes. Local control systems Functional diagrams of automation. Types and principle of operation of measuring instruments and measuring transducers in automation systems. Electrical, hydraulic and pneumatic actuators. Electronic elements of automation systems. Programmable logic controllers. Microprocessor automation systems. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Шандров Б.В. Технические средства автоматизации: учебник / Б.В. Шандров, А.Д. Чудаков. - М. : Академия, 2010 - 368с. - (Высшее профессиональное образование).  2. Технические средства автоматизации и управления: учебник для академического бакалавриата / О. С. Колосов [и др.]; под общ. ред. О. С. Колосова. - М.: Издательство Юрайт, 2018. - 291 с.  3. Шишмарёв В. Ю.  Технические измерения и приборы. М.: Издательство Юрайт, 2019. - 377 с.  4. Старостин А. А. Технические средства автоматизации и управления: учеб. пособие / А. А. Старостин, А. В. Лаптева. — Екатеринбург: Изд-во Урал. ун-та, 2015.  5. Шишов О.В. Современные средства АСУ ТП : учебник / О.В. Шишов. - М. : Инфра-Инженерия; Вологда, 2021. - 532 с.  6. Рогов В. А.   Технические средства автоматизации и управления: учебник для СПО. - М.: Издательство Юрайт, 2017.  7. Рачков М. Ю.   Технические средства автоматизации: учебник для академического бакалавриата / М. Ю. Рачков. — 2-е изд., испр. и доп. — М.: Издательство Юрайт, 2018. — 180 с.  8. Смирнов, Ю.А. Технические средства автоматизации и управления [Текст] : учеб.пособие / Ю.А. Смирнов. - СПб. : Лань, 2017; М.; Краснодар. – 456 с.  9. Латышенко К. П. Технические измерения и приборы в 2 т. Том 1 в 2 кн. Книга 2. - М.: Издательство Юрайт, 2018.  10. <https://www.sciencedirect.com/search?qs=data-science> |

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| **Module name** | **MAС-B23 - Linear and Non-linear**  **Automatic Control Systems** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Associate Professor, PhD Abzhanova Laulasyn Kosylganovna (Kazakh lang.)  Senior Lecturer Atalykova Alfiya Kenesovna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, university component |
| **Teaching methods** | lecture, practical seminars, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 210 hours  **Class hours:**  lectures -15; practical classes -15; laboratory classes - 30; SSW – 144 (SSTS -22)  **Examination preparation hours:** 6 |
| **Credits** | 7 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation/Technical means of automation  Mathematical basis of automation / Mathematical methods in automation issues  Theoretical basis of electrical engineering |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** acquisition of knowledge used to solve automation and control problems; acquisition of skills to solve problems of analysis and synthesis of linear, nonlinear and discrete systems.  **LEARNING OUTCOMES:** To apply in practice the knowledge of the main types of linear, nonlinear and discrete automatic control systems, their mathematical description and modeling. To perform calculations on the analysis and synthesis of control systems.  **Bachelor’s students know:**  - basic principles and schemes of automatic control;  - Basic types of automatic control systems (ACS), their mathematical description and basic research problems;  - Fundamental mathematical bases of processes analysis in linear, nonlinear and discrete systems.  **are able to:**  - apply mathematical methods to analyze the general properties of linear, nonlinear, and discrete systems;  - perform computational work on the analysis of stability and quality of systems;  - apply methods of analysis and synthesis of linear, nonlinear and discrete ACS;  - to carry out computational work on the synthesis of parameters and corrective links according to the given requirements for the quality of functioning of systems.  **Competences:**  to demonstrate experience in analysis and synthesis of linear, nonlinear and discrete ACS;  - to demonstrate skills in designing ACS according to the given requirements for the quality of system functioning;  - to demonstrate skills in analysis of reference and normative literature. |
| **Content** | Automatic systems and problems of the theory of control and regulation. Control and regulation in engineering, objects and ACS. Principles of construction of ACS. Functional description of ACS and their elements. Features of linear, nonlinear and discrete automatic control systems, their main types and mathematical description. |
| **Current control** | Course paper, midterm control 1, 2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Первозванский, А.А.Курс теории автоматического управления: учеб.пособие.- 2-е изд., стер.- СПб.: Лань, 2010.- 624с. 2. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 3. Бекбаев А. Сызықты және бейсызықты жүйелердің автоматты реттеу теориясы. Есептер жинағы. - Алматы, 2012. 4. Гайдук, А.Р. Теория автоматического управления в примерах и задачах с решениями в MATLAB.- М.: Горячая линия-Телеком, 2011.- 464с. 5. Малафеев, С.И. Теория автоматического управления: учебник. - М. : Академия, 2014. - 384с 6. Певзнер, Л.Д. Теория систем управления: учеб.пособие. - 2-е изд., испр. и доп. - СПб. : Лань, 2013. - 424с: 7. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с.   <http://window.edu.ru/resource/389/25389> |

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| **Module name** | **MAС-B24-1 - Computer networks in control systems** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Associate Professor, Candidate of Technical Sciences Sagyndykova Sholpan Nazarovna (Kazakh lang.)  Associate Professor, Ph.D. Syabina Natalia Valerievna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Industrial networks and interfaces" |
| **Teaching methods** | lectures, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology  Basics of collecting and transmitting information  Database Management Systems / Database Design |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to study the basics of computer networks, to master modern local network technologies and ways to support them.  **LEARNING OUTCOMES:**  **Bachelor’s students know:**   * principles of computer networking; * basic types of network architectures; * basic topologies and hardware components of computer networks; * methods of access to the data transmission environment; * basic technology of local area networks; * principles of organization and functioning of global networks;   **Are able to:**   * work with networking software; * administer computer networks; * analyze and evaluate the architecture of computer - networks and its components, information processes, - calculate the quality and performance of the network.   **Competences:**  To have knowledge of modern computer, information, communication technologies and software used to create automation systems;  To Demonstrate skills in using technical capabilities of information reception-transfer means and software products to solve automation problems;  To demonstrate the ability to analyze reference and regulatory literature. |
| **Content** | Principles of computer networks, the main types of network architectures. Hardware and software using networks in control systems. Topologies of networks, methods of access to the data transmission medium. Basic technologies of local networks. Principles of organizing remote access. Analysis and evaluation of the architecture of the network and its components. Calculation of indicators of quality and efficiency of network operation. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Сенкевич А.В. Архитектура ЭВМ и вычислительные системы: Учебник. - М.: Academia, 2018. 2. Галас В. П. Вычислительные системы, сети и телекоммуникации: учебник. //ч.2. Сети и телекоммуникации. – Владимир: Изд-во ВлГУ, 2017. 3. Олифер В., Олифер Н.. Компьютерные сети. Принципы, технологии, протоколы. - СПб: Питер, 2016. 4. Танненбаум Э., Уэзеролл Д. Компьютерные сети. -- СПб: Питер, 2016. 5. <https://www.netacad.com/ru/courses/packet-tracer>   <https://www.youtube.com/playlist?list=PLcDkQ2Au8aVNYsqGsxRQxYyQijILa94T9> |

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| **Module name** | **MAC-B24-2 - Industrial networks and interfaces** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Associate Professor, Candidate of Technical Sciences Sagyndykova Sholpan Nazarovna (Kazakh lang.)  Associate Professor, Ph.D. Syabina Natalia Valerievna (Russian lang) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Computer Networks in Control Systems" |
| **Teaching methods** | lectures, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and Communication Technology  Basics of collecting and transmitting information |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to study the basics of computer networks, protocols and interfaces of industrial networks used in the field of automation of technological processes and industries.  **LEARNING OUTCOMES:**  **Bachelor’s students know:**   * The principles of building computing networks;   basic topologies and hardware components of computer networks;   * Methods of access to the data transmission environment;   specific requirements for industrial networks, standards and types of industrial networks; models, technologies, protocols and interfaces used for various automation objects;  **are able to:**  work with networking software;  form the requirements for the industrial network of the automation object; use network technologies to implement the industrial network;  choose the model and type of industrial network, protocols and interfaces, network equipment.  **Competences:**  demonstrate skills in designing an industrial network using modern computer and communication technologies;  demonstrate proficiency in technical capabilities of information receiving-transfer means and software products to solve automation problems;  demonstrate the ability to analyze reference and regulatory literature. |
| **Content** | The main components of industrial networks. General principles of construction of industrial networks, their architecture, hardware and software. Models, standards, types, interfaces and protocols of industrial networks. Wireless industrial networks. Basic topologies and redundancy in industrial networks. Basic topologies and redundancy in industrial networks. Designing multilevel industrial networks. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Кангин, В.В. Аппаратные и программные средства систем управления. Промышленные сети и контроллеры: учеб.пособие / В.В. Кангин, В.Н. Козлов. - М. : Бином, 2013. 2. Сурядный, А.С. Компьютеры, программы, сети / А.С. Сурядный, М.В. Цуранов. - М. : Астрель, 2012. 3. Олифер, В.Г. Компьютерные сети,принципы технологии протоколы: учеб.пособие. - СПб. : Питер, 2013. 4. Скляров О. К., Волоконно-оптические сети и системы связи : учеб. пособие / О.К. Скляров. - СПб. : Лань, 2021; М.; Краснодар. 5. Таненбаум, Эндрю С. Компьютерлік желілер: оқулық. 1-бөлім / С. Таненбаум Эндрю , ж. Уэзеролл Дэвид Д; ҚРБжҒМ; ауд. А.М.Махметова, С.Б.Беркімбаева. - Алматы : Дәуір, 2013. 6. Баялы Ә.Т., Желілік технология негіздері : оқу құралы / Ә.Т. Баялы. - Алматы : Эверо, 2021.   Вычислительные системы, сети и телекоммуникации [Текст]: учеб. пособие / А.П. Пятибратов, Л.П. Гудыно, А.А. Кириченко; под ред.а.- М.: Финансы и статистика; ИНФРА-М, 2013. |

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| **Module name** | **MAС-B25 - Information Security in Control Systems** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Associate Professor, Candidate of Technical Sciences Sauanova Klara Tagaevna (Kazakh, Russian lang.) |
| **Language** | 5 |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology (in English)  Software implementation of engineering problems in C++/C++ Programming technologies in automation issues  Database Management Systems/Database Design  Basics of collecting and transmitting information |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to study typical information security solutions in management systems.  **LEARNING OUTCOMES:** mastering of modern computer, information, communication technologies and software used in the creation and operation of automation systems.  Bachelor’s students know:  - Basic concepts of information security;  - The main areas of information protection;  - Standards and specifications in the field of information protection;  - Modern methods and means of information protection in information and telecommunication systems;  - The architecture of protected information systems.  Are able to:  - demonstrate proficiency in information security methods and tools  - develop the information security policy of an enterprise;  - assess threats to the security of an object;  - apply methods of vulnerability assessment in information and telecommunication networks;  - apply modern information protection software tools  - design information protection systems.  **Competences:**  - to demonstrate the ability to use various types of information and communication technologies in personal activities: Internet resources, cloud and mobile services to search, store, process, protect and disseminate information;  - to demonstrate the ability to participate in the development of design and working technical documentation, registration of completed design and engineering works in accordance with standards, technical specifications and other regulatory documents;  - to demonstrate the ability to conduct experiments according to a given methodology and analyze the results using the appropriate mathematical apparatus. |
| **Content** | Information security, threat analysis. Principles of information protection in management systems. Standards and specifications in the field of information security. Legislative, administrative, procedural levels of information security. Technical means and methods of protecting information. Hardware-software complexes for protection of information. Identification and authentication. Access control. Logging and auditing, encryption, integrity control. Computer network security. Protection of operating systems. |
| **Current control** | CGW, midterm test 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | **Facilities for successful module implementation:**  Personal computer, software, laboratory equipment |
| **References** | 1. Мусапирова, Г.Д. Ақпаратты қорғау және ақпараттық қауіпсіздік [Мәтін] : оқу құралы / Г.Д. Мусапирова; ҚРБжҒМ, КЕАҚ АЭжБУ. - Алматы : АЭжБУ, 2017. - 70б 2. Аяжанов, Қ.С. Ақпараттық қауіпсіздік және ақпаратты қорғау [Мәтін] : оқулық / Қ.С. Аяжанов, А.С. Есенова; ҚРБжҒМ. - Алматы : Дәуір, 2011. - 376б 3. Баранова Е.К. Информационная безопасность и защита информации.-М.: «РИОР», «ИНФРА-М»,2014 4. Шаньгин В.Ф., Комплексная защита информации в корпоративных системах : учеб. пособие / В.Ф. Шаньгин. - М. : ФОРУМ: ИНФРА-М, 2020. - 592 с 5. <https://studref.com/441529/informatika/zaschita_informatsii_kurs_lektsiy>   http://krotpovorot.narod.ru/mszki.pdf |

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| **Module name** | **MAС-B26-1 - Programming of digital technology and microcontrollers** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Senior Lecturer, MSc Asem Tursyngalievna Ibrasheva (Kazakh lang.)  Senior lecturer, MSc Teacher Zikirbay Kuanysh (Kazakh lang.)  Associate Professor, Candidate of Technical Sciences Fedorenko Igor Anatolyevich (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "PLC Software" |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and Communication Technology, Physics, Elements and devices of automation / Technical means of automation |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to give students basic knowledge and skills of using digital technology and microcontrollers in creating automation and control systems, PIC microcontroller programming skills.  **LEARNING OUTCOMES:**  **Bachelor's students know:** the principles of digital technology and microcontrollers, functions of microcontrollers, design features of microcontrollers;  **are able to:** design the basic hardware products of microcontroller system, design the software and structure of microcontroller system;  **Competences:**  demonstrate ability in the area of microcontroller implementation in a control system;  - use deep theoretical and practical knowledge in the field of digital technology and microcontrollers;  - demonstrate proficiency in microcontroller-based control system software development methods. |
| **Content** | Structure, conditions of functioning of digital automatic control systems. The processor core. Organization of memory. Functional modules (input-output ports, timer-counters, interrupt system, analog-digital and digital-analog converters, etc.). The command system, their capabilities on the example of PIC controllers. Algorithmic software and programming techniques for solving practical engineering problems related to the collection, processing and transmission of technological data. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. 1. Болтон, Уильям. Мехатроника: Машина жасау және электротехникадағы электрондық басқару жүйелері=Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering: оқулық; ҚРБжҒМ; [қаз.тіл.ауд. С. Айжамбаева, Н. Айжамбаев]. - 6-ші бас. - Алматы : Дәуір, 2017. - 328 б: 20,5 б.т. 2. 2. Шанаев, О.Т. Микропроцессорлық техника негіздері: оқу құралы / О.Т. Шанаев, Б.С. Байкенов; ҚР БжҒМ, КЕАҚ АЭжБИ. - Алматы : АЭжБУ, 2012. - 83б 3. 3. Водовозов А.М., Микроконтроллеры для систем автоматики : учеб. пособие / А.М. Водовозов. - М. : Инфра-Инженерия, 2018. - 164 с. 4. 4. Гуров, В.В. Микропроцессорные системы: учебник. - М. : ИНФРА-М, 2016. - 336с. 5. 5. Тарасов В. М., Ибрашева А.Т. Сандық техниканы және басқару микробақылауыштарын программалау. 5В070200-«Автоматтандыру және басқару» мамандығының студенттері үшін зертханалық жұмыстарды орындауға арналған әдістемелік нұсқау - Алматы: АЭжБУ, 2013. – 56б. 6. 6. <https://www.youtube.com/channel/UCXgs4exdtMpz4ccBZS3Yp4g> 7. 7. <https://www.youtube.com/watch?v=U0ToODVBK48> 8. <https://narodstream.ru/pic_urok_1_znakomstvo_s_semejstvom_pic/> |

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| **Module name** | **MAC-B26-2- PLC software** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Senior Lecturer, MSc Asem Tursyngalievna Ibrasheva (Kazakh lang.)  Associate Professor, Candidate of Technical Sciences Fedorenko Igor Anatolievich (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Programming of digital technology and microcontrollers" |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and Communication Technology, Physics, Elements and devices of automation / Technical means of automation, Software implementation of engineering problems in C++/C++ Programming technologies in automation issues |
| **Module objectives/intended** learning **outcomes** | **MODULE AIM:** To give students basic knowledge of 32-bit microcontrollers and skills to use microcontrollers in creating automation and control systems, programming skills of STM32 microcontrollers.  **LEARNING OUTCOMES:**  **Bachelor’s students know:** the principles of 32-bit microcontrollers, functions of microcontrollers, design features of microcontrollers;  **are able to:** design basic hardware products for process control on the basis of 32-bit microcontrollers, design software and structure of microcontroller system;  **Competences:**  demonstrate experience in implementing a 32-bit microcontroller in a control system;  - demonstrate proficiency in microcontroller-based control system software development methods;  - use in-depth theoretical and practical knowledge in selecting microcontroller network interfaces to exchange information with external devices. |
| **Content** | Classification of PLC software. Structure, purpose of the system software. Application software in automation tasks. Programming environment, functionality for developing, debugging and executing the application software. Algorithms of automation and control tasks. Making programs to perform calculations for one-byte and two-byte numbers. Array processing, timer, port and device handling. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Болтон, Уильям. Мехатроника: Машина жасау және электротехникадағы электрондық басқару жүйелері=Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering: оқулық; ҚРБжҒМ; [қаз.тіл.ауд. С. Айжамбаева, Н. Айжамбаев]. - 6-ші бас. - Алматы : Дәуір, 2017. - 328 б: 20,5 б.т. 2. Шанаев, О.Т. Микропроцессорлық техника негіздері: оқу құралы / О.Т. Шанаев, Б.С. Байкенов; ҚР БжҒМ, КЕАҚ АЭжБИ. - Алматы : АЭжБУ, 2012. - 83б 3. Водовозов А.М., Микроконтроллеры для систем автоматики : учеб. пособие / А.М. Водовозов. - М. : Инфра-Инженерия, 2018. - 164 с. 4. Гуров, В.В. Микропроцессорные системы: учебник. - М. : ИНФРА-М, 2016. - 336с. 5. Кузин А.В. Микропроцессорная техника.-М.: «Академия»,2011,2013.-304с. 6. <https://narodstream.ru/programmirovanie-mk-stm32/> 7. <https://www.youtube.com/watch?v=zK_V6OKcLTs> 8. <https://www.youtube.com/watch?v=HwomcPSQsRE> |

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| **Module name** | **MAC-B27-1 - Technical measuring instruments** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Senior Lecturer, MSc Zhanna Serikbayevna Tleubaeva (Kazakh lang.)  Professor, Candidate of Technical Sciences Khan Svetlana Gurievna (Lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Technological measurements and devices" |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Metrology, standardization, certification and quality management/Metrology and measurements; Elements and devices of automation / Technical means of automation |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of students' knowledge and skills on the application of basic information on technical means of measuring produced within the GSP functioning in Kazakhstan, as well as the basic methods of verification and calibration of measuring instruments.  **LEARNING OUTCOMES:**  **Bachelor's student know:**  - classification of technical means of measuring; classification of methods of verification and calibration of technical measuring instruments; schemes, principle of operation of technical measuring instruments; methods of their verification and calibration;  - **are able to:** conduct verification and calibration of technical means of measurement and calculate the total error of measuring channels; correctly use technical means of measurement in specific conditions.  **Competences:**  Demonstrate experience in selecting technical instruments for measuring specific physical quantities.  Collect and interpret data from the results of measurements of technological parameters.  Demonstrate experience in calculating errors of the results of laboratory and technical measurements. |
| **Content** | Information on technical means of measuring produced within the state system of devices and means of automation. Requirements for the operation of measuring instruments and maintenance. Methods for assessing accuracy. The device, principle of operation, methods of verification (calibration) of technical means of measuring. Thermoelectric converters, thermal resistors, secondary devices. Non-contact temperature measuring instruments, gauges, meters, flow meters, level gauges, concentratometers, gas analyzers. |
| **Current control** | Calculation graphic work, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Сергеев А.Г. Метрология,стандартизация и технические измерения.-М.: «Юрайт»,2012. 2. Пустовая О.А. Электрические измерения.-Ростов-на/Д,2010 3. Шишмарев, В.Ю. Технические измерения и приборы [Текст] : учебник / В.Ю. Шишмарев. - М. : Академия, 2010. - 384с. 4. Молдабаева М.Н., Контрольно-измерительные приборы и основы автоматики : учеб. пособие / М.Н. Молдабаева. - М. : Инфра-Инженерия, 2019. - 332 с. 5. Шишов О.В., Современные средства АСУ ТП : учебник / О.В. Шишов. - М. : Инфра-Инженерия; Вологда, 2021. - 532 с. 6. Калиниченко А. В., Справочник инженера по контрольно - измерительным приборам и автоматике : учеб. пособие / А.В. Калиниченко, Н.В. Уваров, В.В. Дойников. - 4-е изд., испр. и доп. - М. : Инфра-Инженерия, 2020; Вологда: 580 с. - 580 с. - (Высшее образование: Бакалавриат). 7. Хан С. Г., Тлеубаева Ж. С. Технические средства измерений: Учебное пособие. -Warsaw: RS Global Sp. z O. O., 2020. - 117 с.   С.Г. Хан, Л.К. Ибраева, Ж.С. Тлеубаева. Өлшеудің техникалық құралдары: Оқу құралы. – Warsaw: RS Global Sp. Z.O.O., АЭжБУ, 2020. – 108 б. |

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| **Module name** | **MAC-B27-2 - Technological measurements and devices** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Senior Lecturer, MSc Zhanna Serikbayevna Tleubaeva (Kazakh lang.)  Professor, Candidate of Technical Sciences Khan Svetlana Gurievna (Lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with “Technical measuring instruments” |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Metrology, standardization, certification and quality management/Metrology and measurements; Elements and devices of automation / Technical means of automation |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of students' knowledge and skills in the application of basic information on technological measurements and instruments used at technological facilities, the basic requirements associated with their operation and maintenance, as well as the basic methods for assessing their accuracy.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  **-** types of measuring parameters at productions with continuous and discrete nature of technological process; principles of measuring such technological parameters as temperature, pressure, level, concentration, quantity and flow rate of substance; schemes, principle of operation of secondary devices;  **- are able to:**  select technical devices and calculate the errors of measurement results; correctly and rationally use technical devices in technological conditions.  **Competences:**  **Demonstrate** experience in measuring technological parameters.  **Demonstrate** analysis of reference and normative literature, execution of technical documentation.  **Demonstrate** the development of technical support for automated process control system. |
| **Content** | General information about technological measurements. Types of measurement parameters in industries with a continuous and discrete nature of the technological process. Measurement of such technological parameters as temperature, pressure, level, concentration, quantity and flow rate of a substance. Schemes and principle of operation of measuring transducers and devices for technological measurements. Methods of processing the results of direct and indirect measurements. |
| **Current control** | Calculation graphic work, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Сергеев А.Г. Метрология,стандартизация и технические измерения.-М.: «Юрайт»,2012. 2. Пустовая О.А. Электрические измерения.-Ростов-на/Д,2010 3. Шишмарев, В.Ю. Технические измерения и приборы [Текст] : учебник / В.Ю. Шишмарев. - М. : Академия, 2010. - 384с. 4. Молдабаева М.Н., Контрольно-измерительные приборы и основы автоматики : учеб. пособие / М.Н. Молдабаева. - М. : Инфра-Инженерия, 2019. - 332 с. 5. Шишов О.В., Современные средства АСУ ТП : учебник / О.В. Шишов. - М. : Инфра-Инженерия; Вологда, 2021. - 532 с. 6. Калиниченко А. В., Справочник инженера по контрольно - измерительным приборам и автоматике : учеб. пособие / А.В. Калиниченко, Н.В. Уваров, В.В. Дойников. - 4-е изд., испр. и доп. - М. : Инфра-Инженерия, 2020; Вологда: 580 с. - 580 с. - (Высшее образование: Бакалавриат). 7. С.Г. Хан. Технологические измеренияи приборы. Учебное пособие. АУЭС. Алматы,2012. - 93 с.   Хан С.Г., Джумагалиев Б.С. Технологиялық өлшеулер және аспаптар. Оқу құралы (жоғарғы оқу орындарының «Автоматтандыру және басқару» мамандығы студентеріне арналған оқу құралы) Алматы: АЭжБУ, 2014. – 92 б. |

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| **Module name** | **MAС-B28 - System software and programming** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Associate Professor, PhD Toibaeva Shara Dzholdaspekovna (Kazakh lang.)  Associate Professor, PhD Syabina Natalia Valerievna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology  Algorithms and data structures  Software implementation of engineering problems in C++/C++ Programming technologies in automation issues  Database management systems/Database design |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** gaining knowledge about the architecture of system software, methods of distribution of computing systems resources and their management, getting knowledge about the basics of building system software components, obtaining practical skills of low-level programming in C/C++, as well as practical skills of working with operating systems.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  The architecture and components of modern operating systems;  the basic principles of building system programs;  strategies for planning computing processes;  basic principles of system resource allocation;  basics of operating systems resource management;  the principles of organizing the interaction of processes;  features of file systems;  basics of building programming systems and the principles of their functioning;  **are able to:**  use the capabilities of low-level programming in C/C++ language;  know how to work with the command line and develop batch files in the WINDOWS operating system;  practically work with the Windows PowerShell command shell;  apply system software in the field of process and production automation;  practically work with a virtual machine.  **Competences:**  demonstrate proficiency in modern computer, information, communication technologies and software;  Demonstrate programming skills in high-level languages, tools and software for modeling ACSPP. |
| **Content** | Architecture system software . Programming systems, principles of building converters, composition of programming languages, general optimization scheme, converting problem statement, conversions, linkers, converters, recognizers, verifiers. Features of resource allocation and management. Interaction of processes in operating systems of different purposes. Application of system software to solve engineering problems in process automation. |
| **Current control** | Calculation graphic work, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. 1. Молчанов А.Ю. Системное программное обеспечение. - СПб.: Питер, 2018. 2. 2. Евдокимов А. А. Системное программирование: учебное пособие - Тамбов: Изд-во ФГБОУ ВПО "ТГТУ", 2016. 3. 3. Сябина Н.В. Системное программное обеспечение и программирование. Конспект лекций для студентов специальности 5В070200 – Автоматизация и управление. – Алматы: АУЭС, 2015. 4. 4. <https://tproger.ru/translations/powershell-tutorial/> 5. <https://remontka.pro/virtualbox/> |

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| **Module name** | **MAС-B29 - Systems of industrial pneumoautomatics and electropneumoautomatics** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Senior Lecturer, MSc Rudakova Larisa Nikolaevna (Russian lang.) |
| **Language** | Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation / Technical means of automation, Technical measuring instruments / Technological measurements and devices |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** studying the basics of the structure and operating principles of pneumomachines, distributing, regulating and auxiliary pneumatic equipment, as well as the rules of building schematic diagrams and graphic symbols of the individual elements of the systems.  **LEARNING OUTCOMES:** Formation of students' knowledge and practical skills in the use of pneumatic mechanisms and systems, as well as the design, installation and maintenance of industrial pneumatic and electro-pneumatic automation systems.  **Bachelor's students know:**  **-** The elementary basis of pneumatics and electropneumatics;  - structure of pneumatic and electropneumatic systems;  - design and principle of operation of the main pneumatic and electro-pneumatic elements;  - basic control circuits, forms of process representation;  - maintenance of pneumatic systems with electric and pneumatic control;  - basic trends in the development of electropneumatic systems, modern principles of building electropneumatic systems used in industry;  **are able to:**  **-** draw up pneumatic and electrical diagrams;  - select types and sizes of the main elements of the system;  - maintain and operate installations with pneumatic and electropneumatic systems;  - detect and troubleshoot pneumatic systems.  **COMPETENCES:**  **-** Demonstrate proficiency in designing, assembling, and testing basic schematics of electropneumatic control systems;  - demonstrate experience using regulatory documents, reference literature and other information sources when selecting and calculating basic types of pneumatic equipment. |
| **Content** | Fundamentals of the theory of pneumatic actuators. Typical structures, principles of construction and operation of pneumatic systems and electro-pneumatic automatics. Single- and double-acting pneumatic cylinders, rotary pneumatic motors and pneumatic motors. Special pneumatic actuators, guides and other control units of pneumatic equipment. Pneumatic control circuits. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Пашков Е.В., Осинский Ю.А., Четверкин А.А. Электропневмоавтоматика в производственных процессах: Учебное пособие/ Е.В. Пашков, Ю.А. Осинский Ю.А, А.А. Четверкин: Под ред. Е.В. Пашкова. - 2-е изд., перераб. и доп. - Севастополь: Изд-во СевНТУ, 2003. - 496 с.  2. Шандров Б. В. Технические средства автоматизации: учебник для студeнтов высших учебных заведений. Москва. Издательский центр «Академия», 2007. — 368 с.  3. Рогов В. А.   Технические средства автоматизации и управления: учебник для СПО. - М.: Издательство Юрайт, 2017.  4. Преде Г., Шольц Д. Электропневмоавтоматика. Основной курс. Учебник "Фесто-РФ", Москва, 2003 г. -295 с.  5. Эбель Ф., Идлер З., Преде Г., Шольц Д. Основы пневматики и электропневмоавтоматики: Учебник. Издание Festo, 2013 - 212 с. |

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| **Module name** | **MAС-B30 -** **Software Engineering** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Associate Professor, PhD Toibaeva Shara Dzholdaspekovna (Kazakh lang.)  Associate Professor, PhD Syabina Natalia Valerievna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Software implementation of engineering problems in C++/C++ Programming technologies in automation issues  Database Management Systems/Database Design  System software and programming  Computer networks in control systems  Information security in control systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to give students the knowledge and practical skills of independent software design and documentation development.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - basic principles of software product design;  - basic operational and functional requirements for software products;  - methods of ensuring manufacturability of software;  - basic methods and approaches to the development of user interfaces;  - methods of debugging, testing and documenting software;  **are able to:**  - Perform pre-project research and problem formulation;  - develop the requirements specification;  - make fundamental decisions at the initial stages of design  - develop and describe algorithms to solve problems using various notations;  - develop the necessary UML-diagrams to describe the software;  - develop user interface models with subsequent implementation;  - perform testing, debugging, and development of accompanying documentation;  - Perform project management using MS Project.-  **COMPETENCES:**  Demonstrates proficiency in modern computer, information, and communication technology;  Demonstrates software design and implementation skills;  be able to analyze reference and regulatory literature, design technical documentation. |
| **Content** | Principles of software design, features of user interface development, project management. Pre-project research and problem statement, development of terms of reference and making basic decisions of the initial stages of design. Quantitative and qualitative risk assessment of the project, the development of algorithms, structure and functionality of software products. Development of user interfaces, organization of project management with the help of modern computer-aided design systems. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. 1. Гагарина Л.Г. Технология разработки программного обеспечения.-М.: Форум, 2017. 2. 2. Скопин И.Н. Основы менеджмента программных проектов. – М., Национальный Открытый Университет "ИНТУИТ", 2016. 3. 3. Сябина Н.В. Основы инженерии программного обеспечения. Конспект лекций для студентов специальности 5В070200 – Автоматизация и управление. – Алматы: АУЭС, 2015. 4. 4. Котляров В.П. Основы тестирования программного обеспечения.- М., Национальный Открытый Университет "ИНТУИТ", 2016. 5. 5. Непейвода Н.Н. Стили и методы программирования. Курс лекций. - М.: Интернет-университет информационных технологий, 2016. 6. 6. [Битти Дж.](https://www.ozon.ru/person/bitti-dzhoy-27995146/), [Вигерс К](https://www.ozon.ru/person/vigers-karl-i-1597231/). Разработка требований к программному обеспечению. – СПб.: [БХВ-Петербург](https://www.ozon.ru/publisher/bhv-peterburg-1098685/), 2019.   7. Брукс Ф. Мифический человеко-месяц или как создаются программные системы / Ф. Брукс. — М.: СПб: Символ  8. [http://citforum.ru/SE/project/arkhipenkov lectures/](http://citforum.ru/SE/project/arkhipenkov%20lectures/) |

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| **Module name** | **MAС-B31 - Automation of control objects** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Associate Professor, PhD Bazil Gulmira Duisenbekyzy (Kazakh lang.)  Senior lecturer Vladimir Pogrebnyak (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation / Technical means of automation, Technical measuring instruments / Technological measurements and devices |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Formation of necessary knowledge and skills of future specialists in the field of performing structural and functional synthesis of typical automation systems, application of methods of mathematical modeling and analysis of parallel processing processes, including deterministic and stochastic interpretations of the model.  **LEARNING OUTCOMES:** Mastering the tasks and principles of creating an automated control system of technological processes and enterprises. Ability to select a set of technical means of control and supervision. Participation in the development of practical measures for the creation of normative, reference, methodological documentation. Determination of mathematical characteristics and performance of the structural and functional analysis of control systems of technological processes, synthesis of automatic and automated systems on the basis of modern technical and software tools.  **Bachelor's students know:**  - methods of research and description of typical technological objects;  - methods of building mathematical models and typical schemes of production processes;  - classification of models, composition and functions of automated control systems.  **are able to:**  - develop basic automation schemes of typical technological installations;  - distribute technical means of automation by hierarchical features and distinguish the principles of building technical support of production control systems and the main stages of development and implementation of typical ACS.  **COMPETENCES:**  - Use in-depth theoretical and practical knowledge in analyzing a process as the object of a control system and evaluating its effectiveness;  - demonstrate the choice of the type of model and control scheme for a particular process. |
| **Content** | Tasks and principles of building automated control systems of technological processes and enterprises. Stages of design and implementation. The choice of a set of technical means of control and management. Normative, reference, methodological documentation. Mathematical description of automated process control systems, structural and functional analysis. Synthesis of automatic and automated systems based on modern technical and software tools. Methods of processing information in the ACS. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. [Андреев](https://www.litres.ru/sergey-andreev-11285838/) С. А.,  [Бородин](https://www.litres.ru/ivan-fedorovich-borodin/) И. Ф. Автоматизация технологических процессов и системы автоматического управления 2-е изд., испр. и доп. Учебник для СПО. – М.: Юрайт, 2017 2. Ю. Н. Федорова «Справочник инженера по АСУТП: Проектирование и разработка. Том 2», Инфра-Инженерия, 2016 3. Селевцов Л.И. Автоматизация технологических процессов : учебник для студ. учреждений сред. проф. образования / Л. И. Селевцов, А. Л. Селевцов. — 3-е изд., стер. — М. : Издательский центр «Академия», 2014. — 352 с. 4. Погребняк В.В. Расчетно-графические работы по курсу «Автоматизация типовых технологических процессов и производств» для студентов специальностей 5В070200- «Автоматизация и управление», АУЭС, Алматы, 2019   **Интернет ресурсы:**   1. <https://www.studentlibrary.ru/book/ISBN9785437200735.html> 2. <http://www.library.ugatu.ac.ru/pdf/teach/> Ivanov\_avtomatizacija\_tech\_proc\_2015\_2izd.pdf 3. [https://books.academic.ru/book.nsf/63029207/ Автоматизация+производства](https://books.academic.ru/book.nsf/63029207/%20Автоматизация+производства) |

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| **Module name** | **MAС-B32-1 - Microprocessor complexes in control systems** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Senior Lecturer, MSc Asem Tursyngalievna Ibrasheva (Kazakh lang.)  Senior lecturer, MSc Kim Elena Sergeevna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with “Basics of distributed control systems” |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Programming of digital technology and control microcontrollers / PLC software, Elements and devices of automation / Technical means of automation, Technical measuring instruments / Technological measurements and devices |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to study the basic elements of microprocessor systems, mastering the structure of microprocessor controllers, strengthening programming skills and studying the principles of building software and hardware complexes of microprocessor systems.  **LEARNING OUTCOMES:**  **Bachelor’s students know:** principles of microprocessor systems design, basics of microprocessor controllers hardware programming language; principles of freely programmable logic controllers; principles of SCADA-based control room design.  **are able to:** design basic hardware products of microprocessor systems, design software of microprocessor systems, design structure of freely programmable logic controllers;  **COMPETENCES:**  - Demonstrate proficiency in selecting a freely programmable logic controller for a specific technological process;  - Demonstrate ability to evaluate equipment effectiveness;  - demonstrate the ability to integrate the controller into a control system;  - demonstrate experience in developing and processing a programmable logic controller program. |
| **Content** | Industrial controllers and microprocessor complexes in automation and control tasks: types of structures, information and control functions, development trends. Characteristics and functionality of industrial controllers Siemens, ABB, Honeywell, Aries, B&R. Data types, memory areas. Programming languages - LAD, FBD, STL. Basic mathematical and logical operations, operations with counters and timers. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Шанаев, О.Т. Микропроцессорлық техника негіздері: оқу құралы / О.Т. Шанаев, Б.С. Байкенов; ҚР БжҒМ, КЕАҚ АЭжБИ. - Алматы : АЭжБУ, 2012. - 83б 2. Кангин В.В. Аппаратные и программные средства систем управления. Промышленные сети и контроллеры.-М.: «Бином»,2010,2013. - 418c. 3. Медведев М.Ю. Программирование промышленных контроллеров.-СПб.: «Лань»,2011.-288с. 4. Копесбаева А.А. Микропроцессорные комплексы в системах управления.-А.,2010. - 126с 5. Компьютерные технологии и микропроцессорные средства в автоматическом управлении/ Б.А. Карташов, А.С. Привалов, В.В. Самойленко и др.- Ростов-на/Д.: Феникс, 2013.- 540с: 6. Копесбаева А.А., Ким Е.С. Микропроцессорные комплексы в системах управления. Методические указания к выполнению лабораторных работ для специальности 5В070200 – Автоматизация и управление. – Алматы: АУЭС, 2020 – 39 с. 7. <https://www.youtube.com/c/PLCProgrammingCourses> 8. <https://www.youtube.com/channel/UCYubL6uvIMYSupoAhEVtgYg/videos>   <https://present5.com/promyshlennye-kontrollery-lekciya-1-osnovnye-ponyatiya-i/> |

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| **Module name** | **MAU-B32-2 - Basics of Distributed Control Systems** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Senior Lecturer, MSc student Asem Tursyngalievna Ibrasheva (Kazakh lang.)  Senior teacher, MSc Teacher Kim Elena (Russian lang.) |
| **Language** | Kazakh/ Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Microprocessor complexes in control systems |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Programming of digital technology and control microcontrollers / PLC software, Elements and devices of automation / Technical means of automation, Technical measuring instruments / Technological measurements and devices |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to familiarize students with modern components of distributed control systems, to study methods of creating effective automation systems of technological processes based on modern components.  **LEARNING OUTCOMES:**  **Bachelor's students know:** principles of building production distributed control systems, production networks, capabilities of programmable logic controllers in distributed control systems, structure and functionality of modern distributed control systems  **are able to:** design software programmable logic controllers to implement the standard functions of control systems, creation of modern projects of distributed control systems.  **COMPETENCES:**  - Demonstrate proficiency in selecting equipment configurations for building distributed control systems, as well as selecting its elements and interfaces;  - use in-depth theoretical and practical knowledge in software development for distributed control systems;  - demonstrate experience in integrating an industrial controller into a control system. |
| **Content** | Definition of the term DCS; general trends of DCS development; DCS components: PLC, SCADA-programs, industrial networks; characteristics; capabilities of DCS components; conditions of DCS interaction; tasks to be solved; general structure of DCS and functional capabilities of modern DCS; study of DCS capabilities - Plan Sceip, Ovasion, PCS-7. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Шанаев, О.Т. Микропроцессорлық техника негіздері: оқу құралы / О.Т. Шанаев, Б.С. Байкенов; ҚР БжҒМ, КЕАҚ АЭжБИ. - Алматы : АЭжБУ, 2012. - 83б 2. Кангин В.В. Аппаратные и программные средства систем управления. Промышленные сети и контроллеры.-М.: «Бином»,2010,2013. - 418c. 3. Медведев М.Ю. Программирование промышленных контроллеров.-СПб.: «Лань»,2011.-288с. 4. Копесбаева А.А. Микропроцессорные комплексы в системах управления.-А.,2010. - 126с 5. Компьютерные технологии и микропроцессорные средства в автоматическом управлении/ Б.А. Карташов, А.С. Привалов, В.В. Самойленко и др.- Ростов-на/Д.: Феникс, 2013.- 540с: 6. Иванов А.А., Управление в технических системах : учеб. пособие / А.А. Иванов, С.Л. Торохов. - М. : ФОРУМ, 2020. - 272 с. - (Высш.образование). 7. <https://www.youtube.com/c/PLCProgrammingCourses> 8. <https://www.youtube.com/channel/UCYubL6uvIMYSupoAhEVtgYg/videos>   <https://present5.com/promyshlennye-kontrollery-lekciya-1-osnovnye-ponyatiya-i/>  9. <https://bookasutp.ru/Chapter1_1_3.aspx> |

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| **Module name** | **MAU-B33 - Modeling and Identification of Control Objects** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Professor, Candidate of Technical Sciences Ibrayeva Lida Kuandykovna (Kazakh, Russian lang.) |
| **Language** | Kazakh/ Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, university component |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Linear and non-linear automatic control systems, Mathematical basis of automation / Mathematical methods in automation issue |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of students' knowledge and practical skills of mathematical models independent construction of objects and control systems, their research on the computer and use to create control systems of technological processes.  **LEARNING OUTCOMES:** to apply in practice the knowledge of the main types of linear and nonlinear automatic control systems, their mathematical description and modeling. Perform calculations for the analysis and synthesis of regulatory systems.  **Bachelor's students know:**  - mathematical description of elementary physical processes that are components of complex processes;  - basic dynamic characteristics of the control object considered as a model of this object;  - Analytical methods of modeling;  - methods of identification of control objects;  **are able to:**  - Analyze complex technological processes in order to build their mathematical models;  - choose a method for modeling the object or process under study (analytical or experimental)  - make a structural scheme of the model;  - conduct studies of the developed model in specialized software;  - interpret obtained. results  COMPETENCES:  - To have knowledge of the place of models in the structure of the control system;  - develop models of control objects based on analytical approach;  - possess the skills of parametric and nonparametric identification;  - demonstrate the ability to analyze and interpret the results of modeling the control object;  - demonstrate the ability to apply modern computer, information, communication technologies and software. |
| **Content** | Types and features of modeling processes in dynamic systems. Analytical methods of determining the characteristics of objects. Basic concepts of the theory and types of identification. Parametric and non-parametric identification. Features of identification of nonlinear dynamic objects. Identification methods based on linearization of object characteristics. Functional models. Models that are linear with respect to the estimated parameters. Various tools of the MatLab dynamic system modeling environment. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1 Чикуров Н.Г., Моделирование систем и процессов: учеб. пособие / Н.Г. Чикуров. - М. : РИОР-Инфра-М, 2020. - 400 с. - (Высш.образование-Бакалавриат)  2. Ибраева Л.К. Моделирование объектов систем управления. Учебное пособие для специальности 5В070200- «Автоматизация и управление» - Алматы: АУЭС, 2018.  3. Ибраева Л.К. Моделирование и идентификация объектов управления. Конспект лекций для студентов специальности 5В070200 - Автоматизация и управление - Алматы: АУЭС, 2016.  4. Shiryayeva O.I. Linear Control Systems (using Matlab). Textbook. -Almaty: LLP ‘Dauir”, 2016.  5. Зарубин, В.С. Моделирование: учеб.пособие для вузов. - М. : Академия, 2013. - 336с. - (Высш. проф. образование .Бакалавриат  6. Satyanarayana, P.S. Control System Engineering. - 2nd ed. - New Delhi : MedTech, 2017. - 228p  7. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с .  8. L. K. Ibrayeva. Modeling and Identification of Control Objects.Abstracts of lectures for specialty 5B070200 – Automation and Control. – Almaty:AUPET, 2018. – 66 p..  9.<http://engineering.nyu.edu/mechatronics/Control_Lab/Criag/Craig_RPI/2001/Introduction_DSI&Controls.pdf>  10.<https://www.sciencedirect.com/bookseries/control-and-dynamic-systems/vol/18>  11.<http://home.ubalt.edu/ntsbarsh/simulation/sim.htm>  12. <http://drive.ispu.ru/elib/lebedev/21.html> |

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| **Module name** | **MAU-B35 - Calculation of Automatic Control Systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Abzhanova Laulasyn Kosylganovna (Kazakh lang.)  Associate Professor, PhD Fedorenko Igor Anatolievich (Russian lang.) |
| **Language** | Kazakh/ Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, university component |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Linear and non-linear automatic control systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to study the problems of designing linear automatic control systems.  **LEARNING OUTCOMES:**  To apply in practice the knowledge of the main types of linear and nonlinear automatic control systems, their mathematical description and modeling. Perform calculations on the analysis and synthesis of regulatory systems.  **Bachelor's students know:** designing system stability zones; ways to improve the dynamic properties of systems; methods of tuning typical regulators.  **are able to:** define quality indicators of the system; build the areas of system stability on its parameters; select the type regulators and determine their parameters  **COMPETENCES:**  - Demonstrate experience in solving problems competently to determine the stability domain of linear systems by one and two parameters;  - To use profound theoretical and practical knowledge in solving problems on synthesis of correcting devices;  - Demonstrate mastery of methods for tuning parameters of typical regulators. |
| **Content** | Stages of construction of automatic control systems. Development of mathematical description in the form of differential equations, transfer functions and space state . Algebraic and frequency methods for determining the parameters of regulators for various classes of systems. Structural and parametric synthesis of closed-loop systems. Application of direct and indirect criteria for evaluating the quality of transients. Possibilities of modern software tools for the calculation of automatic control systems. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | Main references:   1. Бекбаев А. Сызықты және бейсызықты жүйелердің автоматты реттеу теориясы. Есептер жинағы-А.,2012 2. Shiryayeva, O.I. Linear control systems (using MATLAB) [Текст] : textbook / O.I. Shiryayeva; MES RK. - Almaty : Dauir, 2016. - 248p 3. Skormin, V.A. Theory of automatic control systems [Текст] : textbook / V.A. Skormin, M.F. Baimukhamedov; MES RK. - Almaty : Bastau, 2017. - 287 p 4. Гайдук, А.Р. Теория автоматического управления в примерах и задачах с решениями в MATLAB.- М.: Горячая линия-Телеком, 2011.- 464с. 5. Малафеев, С.И. Теория автоматического управления: учебник. - М. : Академия, 2014. - 384с 6. Первозванский, А.А. Курс теории автоматического управления: учеб.пособие.- 2-е изд., стер.- СПб.: Лань, 2010.- 624с.- (Учебники для вузов.Специальная литература). 7. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с: Electronic resources: 8. <http://tau-predmet.narod.ru> 9. <http://infotechlib.narod.ru/index/0-16>   <https://www.twirpx.com/files/science/automation/tau/problem_books/> |

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| **Module name** | **MAC-B36 - Building SCADA systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Orkbaev Yerbol Zhumageldievich (Kazakh lang.)  Senior Lecturer, MSc Elena Kim (Russian lang.) |
| **Language** | Kazakh/ Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, university component |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Theoretical basis of electrical engineering  Computer networks in control systems/Industrial networks and interfaces  Microprocessor complexes in control systems / Basics of distributed control systems. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to familiarize students with modern components of SCADA-systems, study methods of building effective systems of automatic and automated control of technological processes, using SCADA software and hardware complexes.  **LEARNING OUTCOMES:** mastering the principles of SCADA-systems, controllers and actuators, methods of building effective systems of automatic and automated control of technological processes using SCADA hardware and software systems.  **Bachelor's know:**  - principles of development and organization of microprocessor devices and development of modern and promising directions of elements and devices of automation;  - areas of application of various automated control systems;  - principles of production design of SCADA-systems, production interfaces and controllers;  - main characteristics and operation principle of devices of programmable technological regulators;  - structural and functional capabilities of modern technological SCADA-system;  **are able to:**  - program microprocessor controllers to form typical functions of automatic control systems;  - Programming of technological controller for formation of typical functions of automatic control systems;  - program bases of modern technical means and control system of technological SCADA-system.  **COMPETENCES:**  - Demonstrate proficiency in the structural and functional capabilities of modern technological SCADA systems;  - demonstrate skills of working in Scada and designing technological processes. |
| **Content** | Modern components and operating principles of SCADA-systems. Methods of building effective systems of automatic and automated control of technological processes using SCADA hardware-software complexes, controllers and actuators operating under SCADA-systems. Programming of industrial controllers to implement the functions of control systems; design of control systems based on modern hardware and technology SCADA-systems. |
| **Current control** | Calculation and graphic work 1, 2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Пантелеев В.Н. Өндірісті автоматтандыру негізі. Бастауыш кәсіптік білім беруге арналған оқу құралы / В. Н. Пантелеев, В. М. Прошин. — 3-ші басылым., өңделген және толық. — М. : «Академия» баспа орталығы 2013.. 2. Даев Ж.А. Өндірістік процестердің автоматтандырылған баскару жүйелерін жобалау және құрастыру/ Ж.А. Даев - ЖОО арналған окулық. Алматы. Альманах, 2018. 3. Алиханов Д. Автоматика негіздері: Оқулық/Ц,. Алиханов, Ж. Шыныбай, А. Кулмахамбетова. - Астана: Фолиант, 2016. 4. [Кангин В. В](https://www.labirint.ru/authors/210527/)., [Ямолдинов Д. Н](https://www.labirint.ru/authors/210529/)., Кангин М. В. Разработка SCADA-систем. Учебное пособие, М.: Издательство «[Инфра-Инженерия](https://www.labirint.ru/pubhouse/2357/)», 2019. - 5. [Музипов Х.Н](https://www.labirint.ru/authors/206264/)., [Мартынюк Р. В](https://www.labirint.ru/authors/207090/)., [Чащина М. В](https://www.labirint.ru/authors/207089/). , [Хохрин С. А](https://www.labirint.ru/authors/207088/)., [Кузяков О.Н](https://www.labirint.ru/authors/207087/).  Интегрированные системы проектирования и управления. SCADA. Учебное пособие, М.: Издательство «Лань», 2018. – 6. Связь с нижним уровнем Master SCADA. Методическое пособие    Видео уроки <https://insat.ru/products/?category=1524> |

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| **Module name** | **MAC-B37- Information Technologies in Control Systems Research** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Professor, Candidate of Technical Sciences Ibrayeva Lida Kuandykovna (Kazakh lang.)  Associate Professor, Candidate of Technical Sciences Syabina Natalia Valerievna (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Modeling and identification of control objects,  Automation of control objects |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to give students a knowledge, skills and abilities to develop and use artificial intelligence technology in professional activities and software that implements them.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  the basic theoretical provisions of the design of neurointelligent systems;  mathematical models and learning algorithms of different classes of neural networks;  **are able to:**  work in specialized neural network programs;  Develop algorithms and programs suitable for practical application in the field of information systems and technologies;  apply neural networks to solve a wide range of applied problems.  **COMPETENCES:**  Demonstrate proficiency in modern intelligent technologies for modeling control systems;  use the technical capabilities of information receiving-transfer means and software products to solve automation problems;  demonstrate skills in analyzing reference and normative literature. |
| **Content** | Technology of modeling control objects using modern modeling tools; main applications of artificial neural networks; training of artificial neural networks; fuzzy neural networks; main applications of artificial neural networks, examples of their application. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Alimseitova Zh.K., Development of an intelligent automated system for biometric pattern recognition : monograph / h.K. Alimseitova Z. - Almaty : AUES, 2020. 2. Агальцов В.П., Математические методы в программировании : учебник / В.П. Агальцов. - 2-е изд. перераб. и доп. - М. : ФОРУМ, 2021: ИНФРА-М. 3. Безруков А. И., Математическое и имитационное моделирование : учеб. пособие / А.И. Безруков, О.Н. Алексенцева. - М. : ИНФРА-М, 2018. 4. Кобелев Н.Б., Имитационное моделирование объектов с хаотическими факторами : учеб.-метод. пособие / Н.Б. Кобелев. - М : ИНФРА-М, 2019: КУРС. 5. Решмин Б.И., Имитационное моделирование и системы управления : учеб. пособие / Б.И. Решмин. - 2-е изд. - М. : Инфра-Инженерия, 2019; Вологда. 6. Советов Б.Я., Моделирование систем: учебник для академического бакалавриата / Б.Я. Советов, С.А. Яковлев. - 7-е изд. - М. : Юрайт, 2019. 7. Трофимов В.Б., Интеллектуальные автоматизированные системы управления технологическими объектами : учеб. пособие / В.Б. Трофимов, С.М. Кулаков. - 2-е изд., испр. - М. : Инфра-Инженерия, 2020; Вологда. 8. Трофимов В.Б., Экспертные системы АСУ ТП : учебник / В.Б. Трофимов, И.О. Темкин. - М.; Вологда: Инфра-Инженерия, 2020. 9. Яворский В.В., Интеллектуальные информационные технологии : учебник / В.В. Яворский. - Алматы : Эверо, 2021. 10. Яворский В.В., Цифровое моделирование систем : [учебник] / В.В. Яворский. - Алматы : Эверо, 2021. |

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| **Module name** | **MAС-B38 - Reliability of control systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Senior teacher Atalykova Alfiya Kenesovna (Kazakh, Russian lang.) |
| **Language** | Kazakh/ Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation/Technical means of automation  Mathematical basis of automation / Mathematical methods in automation issues  Automation of control objects / Automation of energy facilities  Microprocessor complexes in control systems / Basics of distributed control systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of students' minimum knowledge of reliability analysis and calculation of reliability indicators of control systems.  **LEARNING OUTCOMES:**  formation of students' knowledge and practical skills to perform independently calculations of reliability indicators of restored and non-restored systems, calculations of reliability indicators of software and hardware complexes and their components; analyze the reliability of control systems at different stages of their life cycle.  **Bachelor's students know:**  - definitions and concepts of reliability;  - Basic states and events defining the concept of system reliability;  - the principle of describing the reliability of control systems;  - methods of analytical and statistical evaluation of reliability;  - methods for ensuring the reliability of systems during development and operation;  - methods of technical diagnostics;  - basics of quorum-element theory for creating reliable information systems;  - practical ways to build reliable control systems.  **are able to:**  - Calculate the reliability performance of restorable and non-restorable systems;  - correctly apply methods of reliability theory when solving engineering problems.  **COMPETENCES:**  - Demonstrate proficiency in methods of calculating reliability indicators of control systems;  - Demonstrate possession of methods of organizational and technical maintenance of reliability of software and hardware complexes by means of standardization, design solutions and experimental testing, including testing;  - Demonstrate skills in the analysis of reference and normative literature. |
| **Content** | Reliability, basic states and events. Principles of describing the reliability of control systems. Methods of analytical and statistical evaluation of reliability. Methods for ensuring the reliability of systems in development and operation. Reliability rationing of software and hardware complexes and their components. Methods for ensuring the reliability of control systems. Methods for calculating the reliability of reliable control systems. Calculation of reliability indicators of restorable and non-restorable systems. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Малафеев С.И. Надежность технических систем. Примеры и задачи.-СПб.: «Лань», 2012. 2. Әбілдаева, А.С.Басқару жүйесінің сенімділігі мен диагностикасы [Мәтін]: оқу құралы / А.С. Әбілдаева; ҚР БҒМ М. Х. Дулати атындағы Тараз МУ.- Тараз: Тараз университеті, 2018.- 89 б 3. Шишмарев В.Ю. Надежность технических систем.-М.: «Академия»,2010 4. Мякишев Д.В., Принципы и методы создания надежного программного обеспечения АСУТП : Метод.пособие / Д.В. Мякишев. - М. : Инфра-Инженерия, 2018. - 114 с. 5. Малафеев С.И. Надежность технических систем. Примеры и задачи. -СПб.: «Лань»,2021.-316 с. 6. <https://portal.tpu.ru/departments/otdel/publish/izdaniya_razrabotanye_v_ramkah_IOP/Tab/ik_shklyar_nadezhnost_system_upravleniya.pdf>   <https://tstu.ru/book/elib/pdf/2012/shubin.pdf> |

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| **Module name** | **MAС-B39 - Typical design solutions for control systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Senior Lecturer, MSc Shynar Kishikbayevna Adilova (Kazakh lang.)  Senior Lecturer Vladimir Pogrebnyak (Russian lang.) |
| **Language** | Kazakh/ Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, university component |
| **Teaching methods** | lecture, laboratory works, course project, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Linear and non-linear automatic control systems, Designing in AutoCAD, Solid Works / Computer Graphics Basics, Automation of control objects / Automation of energy facilities /Automation of technological processes of production, preparation and transportation of oil /Automation and basics of robot control |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** mastering the basic principles of building typical automated systems of technological processes; gaining practical skills of selecting typical local ACS of technological processes; mastering the practical skills of selecting technical means of automation, setting elements of CS.  **LEARNING OUTCOMES:** To have skills in the selection of modern technical means in the construction of typical control systems.  **Bachelor's students know:**  - use deep theoretical and practical knowledge in the field of typical design solutions in ACS;  about automated control systems;  - basic concepts and terms in the tasks of designing automatic control systems;  - The structure of the typical automatic control system (ACS);  - basics of control of technological objects.  **Are able to:**  - demonstrate possession of methods and tools of complex and use the concepts and terminology of design of automatic control systems;  - make a choice of typical design solution, conduct calculations of static and dynamic characteristics of AC elements;  - perform the simplest adjustments of the typical CS.  **COMPETENCES:**  - Collect and interpret meaningful data in the area of typical design solutions in ACS;  - demonstrate mastery of methods of analysis and selection of typical solutions in automation tasks;  - own modern computer, information, communication technologies and software in the tasks of designing ACS. |
| **Content** | Design principles of automation systems. Development of structural diagrams of automation and a set of technical means, functional and basic electrical diagrams of automation systems. Justification and selection of technical means of monitoring and control. Design of information, mathematical and software of automated control systems. Normative and technical documents, state and international standards for creating automation systems. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Гудвин, Г.К.Проектирование систем управления / Г.К. Гудвин, С.Ф. Гребе, М.Э. Сальгадо; пер.с англ.А.М.Епашникова. - М. : БИНОМ.Лаб.знаний, 2012  2. Целищев Е.С., Автоматизация проектирования технического обеспечения АСУТП : учеб. пособие / Е.С. Целищев, А.В. Котлова, И.С. Кудряшов. - М. : Инфра-Инженерия, 2019. - 195 с.  3. Шыңғысов, Б.Т. Автоматтандырылған жобалау жүйелерінің негіздері : оқулық - Алматы : Лантар Трейд, 2019.  4. Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б.   1. [www.avtomatica.ru/](http://www.avtomatica.ru/) 2. [www.kipia.ru/](http://www.kipia.ru/)   [www.tecon.ru/](http://www.tecon.ru/) |

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| **Module name** | **MAС-B40 - Automated Control Systems for Production Processes** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Bazil Gulmira Düysenbekyzy (Kazakh, Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Automation of Control Objects, Modeling and Identification of Control Objects, Basics of collecting and transmitting information, Computer Networks in Control Systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Teaching the basic principles of building automated control systems (ACS) of production processes, as well as process control systems, allowing to optimize the overall corporate management system, making it transparent to management and able to respond flexibly to changes in the external environment  **LEARNING OUTCOMES:** use modern information technologies, applied software tools when solving problems of professional activity; use modern information technologies, applied software tools when solving problems of professional activity.  **Bachelor's students know:** the principle of information description of technological operations and processes; methods of assessment and optimization of the control object state; composition and structure of automated control, regulation and monitoring systems; hierarchical structure of control systems, technical and software tools of each hierarchy level and principles of their interaction.  **are able to:** evaluate the effectiveness and choose the type of model for specific processes; analyze the control processes of technological processes; make a preliminary calculation of economic efficiency from the introduction of ACS.  **COMPETENCES:**  - Demonstrate the ability to develop operational plans for all activities related to research, development, design, engineering, implementation, and management of technological processes and productions;  - use profound theoretical and practical knowledge in the field of building automated control systems. |
| **Content** | The main characteristics and principles of construction of the ACS. System analysis of technological control objects. The principle of information description of technological operations and processes. Methods for assessing and optimizing the state of the control object. Least squares method, Bayesian estimates, ranking, the principle of maximum. Methods of correlation and regression analysis; stochastic and deterministic models; Methods of analysis and calculation of economic efficiency of the use of the ACS. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1 Схиртладзе А.Г.. Автоматизация технологичесих процессов и производств - М: Арбис, 2012 - 210 б.  2 Парсункин Б.Н.. Автоматизация технологичесих процессов и производств - Магнитогорск "МагниГТУ", 2014 - 213 б.  3 Еренчинов К.К. и др. Автоматизированные системы управления производственными процессами: Метод. указ. по вып. лаб. работ.-АУЭС, 2016.  4 Ившин В.П. Современная автоматика в системах управления технологическими процессами- Инфра-М, 2013 11  5 Реутов А.П. Автоматизированные информационные системы. Методы построения и исследования- М:Радиотехника-2010  6 Схиртладзе А.Г. Интегрированные системы проектирования и управления-М:Академия-2010  7 Схиртладзе А.Г. Технологические процессы автоматизированного производства- М:Академия-2011  Интернет ресурсы:  8 <https://www.studentlibrary.ru/book/ISBN9785437200735.html>  9 http://www.library.ugatu.ac.ru/pdf/teach/ Ivanov\_avtomatizacija\_tech\_proc\_2015\_2izd.pdf  10 https://books.academic.ru/book.nsf/63029207/ Автоматизация+производства |

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| **Module name** | **MAС-B41 - Module of the university component of GED (Basics of Ethics and Anti-Corruption Culture, Ecology and Life Safety, Economics, Entrepreneurship, Leadership and Innovation)** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | **Basics of ethics and anti-corruption culture**: Associate Professor Sarsekeyev Masat Mukashevich (Russian lang.)  Associate Professor Sarsekeyev Masat Mukashevich (Kazakh lang.)  Associated-Professor Sarsekeyev Masat Mukashevich (English lang)  **Ecology and Life Safety:** Associate Professor Abikenova Asel Amangeldievna (Russian lang.)  Associate Professor Abikenova Asel Amangeldievna (Kazakh lang.)  PhD Ainur Serikbayevna Begimbetova (English lang.)  **Economics, entrepreneurship, leadership and innovation:**  Professor Baitenova Laura Maratovna (Russian lang.)  Professor Baitenova Laura Maratovna (Kazakh lang.)  Professor Baitenova Laura Maratovna (English lang.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, University component |
| **Teaching methods** | lecture, practical seminars, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; practical classes -30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Modern History of Kazakhstan, Philosophy, Module of socio-political knowledge (political science, sociology), Module of socio-political knowledge (culturology, psychology) |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  **Basics of ethics and anti-corruption culture:** obtaining knowledge about state measures to counteract corruption, understanding the essence of moral and ethical problems of modern society, as well as factors, principles and conditions affecting their functioning in the sphere of ethical and legal relations.  **Ecology and life safety:** to study peculiarities of technical systems functioning, as well as natural processes and phenomena as sources of ecological and anthropogenic danger. In addition, an additional goal is to familiarize students with the basics of forming a general characteristic of the basic patterns of safe interaction between man and the environment (industrial, domestic, urban), as well as protection from harmful factors in hazardous and emergency situations, sustainable development of nature and society.  **Economics, entrepreneurship, leadership and innovation:** To teach students the scientific and practical foundations of the organization of entrepreneurial activity, the results of the innovation process, the characteristics of the current situation. To prepare students for the free use of theoretical knowledge, which in today's innovation economy should have professional competencies associated with the commercialization of innovation, the process of bringing new technologies, goods and services to the market. |
|  | **LEARNING OUTCOMES:**  **Basics of ethics and anti-corruption culture**  **The bachelor's students must:**  - know the ethical and legal categories, terminology, conceptual apparatus related to combating corruption;  - know the importance and necessity of legal and organisational support of anti-corruption activities.  **be able to:**  - comprehensively and critically analyse the necessary mass of information.  - draw conclusions independently and analyse and process the required volume of diverse information concerning legal processes and phenomena of public conduct.  **Competences:**  - Demonstrate skills of independent analysis of complex and diverse processes and phenomena related to corruption and public behavior  - Demonstrate civic responsibility to actively counteract corrupt behaviour.  **Ecology and life safety**  **know:**  - secure protection of a person's health and ability to work in the practical activity of a specialist;  - regularities of the biosphere development and conditions of its sustainability preservation;  - willingness to act rationally in extreme conditions;  - safety engineering and measures of human protection from industrial factors.  **be able to:**  - identify and analyze natural and anthropogenic ecological processes and possible ways of their regulation;  - understand modern strategies of sustainable development of mankind, aimed at systematic changes in traditional forms of economic management in order to maintain the stability of the biosphere and society without catastrophic crises;  - classify man-made, natural, sociopolitical, and military emergencies; assess levels of risk by level of acceptability.  - determine the level of emergencies by criteria of territorial spread, economic losses and number of victims.  - provide first aid with the help of medical devices and improvised means to the injured in emergencies in accidents at work and at home if there is a threat to their life until the arrival of the ambulance;  - determine the causes of hazards and identify the causes of failures of technical systems.  **Competences:**  - demonstrate skills in analyzing environmental processes, setting specific goals and priorities for sustainable development of nature and society, and using the knowledge gained to solve environmental problems;  - demonstrate the skills of protection from hazardous factors of natural and man-caused emergencies, harmful and dangerous production factors;  - demonstrate the ability to apply norms and rules of industrial and environmental safety, industrial sanitation, fire safety and labor protection. |
|  | **Economics, entrepreneurship, leadership, and innovation**  **know:**  - the market mechanisms of the enterprise in the current 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 of regulation and support of innovations;  - theoretical concepts of leadership organization;  - the concept and content of the economic category;  - the system of economic indicators and their relationship, and methods for their calculation;  - methods for assessing the effectiveness of production;  -principles of methods of calculation of economic efficiency of capital investments in the use of cash and material and labor resources of the enterprise.  **be able to:**  - systematize and model economic phenomena, evaluate the results in accordance with modern methods of research, identify reserves to improve production efficiency;  - demonstrate knowledge and skills in the field of innovation, including knowledge in organizing domestic enterprises in the field of innovation;  - apply his knowledge for creating an effective system of innovation business, as well as have the necessary competencies to solve and justify the problems in the field of research;  - collect and correctly use information about the experience and theoretical foundations of innovative business for decision-making with social, economic, scientific and ethical considerations;  - communicate new information, ideas, problems to specialists and other stakeholders in the field of innovation.  **Competences:**  - demonstrate practical leadership skills;  - the ability to organize jobs in an organization;  - ability to analyze and evaluate the level of organization of production;  - ability to make economic, production and management decisions independently;  - the ability to correctly assess the real economic situation in a changed environment;  - the ability to identify ways and resources to improve the productivity of the enterprise. |
| **Content** | The totality of state-legal phenomena in their normative-legal form and law enforcement practice. Legal culture in the Republic of Kazakhstan, ensuring law and order. Environmental and economic aspects of professional activity. Issues related to the use of natural resources, ensuring environmental safety of the population and territories, preventing the destruction (death) of natural objects, environmental degradation.  **Students study:**  - Issues of ecology and safety of the population, including socio-economic, organizational, technical, hygienic, therapeutic and preventive measures and the system of regulations ensuring the preservation of health and human performance in the process of his life activity.  - Issues of improvement of management and regulation methods, introduction of planning mechanisms adequate to market transformations, pricing, mutual settlements of investment and innovation activities, fundamentals of entrepreneurial activity. |
| **Current control** | Calculation graphic works 3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, 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.  8. <https://aues.kz/ru/site/against-corruption>[http://www.rmeb.kz](http://www.rmeb.kz/)  **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. 7. <http://www.ecolife.ru/intervju/>   **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  6. <http://www.rmeb.kz> |

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| **Module name** | **MAU-B42 - Basics of scientific research and academic writing** |
| **Semester(s), in which the module is taught** | 8 |
| **Person, responsible for the module** | Associate Professor Dosmakhanova Raikul Amandykovna (Kazakh, Russian lang.) |
| **Language** | Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Compulsory, university component |
| **Teaching methods** | lecture, practical classes, term papers, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; practical classes -15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Kazakh (Russian) language 1,2 |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To provide an introduction to the style and language of academic writing; to prepare students to apply specific tools to set up and conduct research as part of the preparation of a graduate qualification paper.  **LEARNING OUTCOMES:**  **Bachelor’s students 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 to:**  - work with scientific and technical literature and special sites on the Internet;  - formulate the goal, objectives, subject and object of scientific work;  - navigate the literature on the topic, use bibliographic resources and search engines for scientific work.  **COMPETENCES:**  - To demonstrate skills in solving cognitive-communicative problems;  - To demonstrate skills of creating own text, following logical sequence and using adequately linguistic means;  - to be able to communicate in a professional sphere, demonstrating a high level of information training. |
| **Content** | The discipline is designed for students with Russian language of instruction of all educational programs, is a basic, university component and belongs to the module "Semi-lingual training". At the lectures the student gets the necessary knowledge on modern bases of scientific research, masters scientific methods of research of professional tasks. In practical classes the solution of cognitive and communicative problems is carried out. SSW provides for the performance of a sufficient number of tasks of both linguistic and creative nature. |
| **Current control** | Course papers, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer. |
| **References** | 1 Академическое письмо. От исследования к тексту: учебник и практикум для вузов / Ю.М. Кувшинская и др. – М.: Издательство Юрайт, 2022. – 284 с. <https://urait.ru/bcode/494312> (доступ по подписке).  2 Баяхметова А.А., Дусенбина М.Ж. Академическое письмо. Язык и стиль академического письма: Учебное пособие. – Костанай: КГУ им. А.Байтурсынова, 2019. – 106 с. <http://test.ksu.edu.kz/files/TB/book/gsf/uchebnoe_posobie_akademicheskoe_pis_mo_2019_12_10_07_58_30_936.pdf>  3 Бубенчиков А.А. Основы научных исследований: учеб. пособие. – Омск: Изд-во ОмГТУ, 2019. – 158 с. <https://disk.yandex.kz/i/NBDMU0Qwk-8AUg>  4 Бурыкин А.Д. и др. Основы научных исследований: методология и рекомендации. Учебное пособие. – Ярославль: ООО «ПКФ «СОЮЗ-ПРЕСС», 2020. – 136 с. <https://yadi.sk/i/MTOvMo8xTVWfNg>  5 Дрещинский В. А. Методология научных исследований: учебник для вузов. – М.: Издательство Юрайт, 2021. – 274 с. 2021. <https://urait.ru/bcode/472413> (доступ по подписке)  6 Квициния М.Б. Академическое письмо. Учебное пособие. – Сухуми: АГУ, 2018. – 145 с. <http://apsnyteka.org/file/Kvitsiniya_M_Akademicheskoe_pismo_2018.pdf>  7 Культура речи. Научная речь: учебное пособие для вузов / В.В. Химик и др. – М.: Издательство Юрайт, 2022. – 270 с. <https://urait.ru/bcode/490882> (доступ по подписке).  8 Шкляр М.Ф. Основы научных исследований. Учебное пособие для бакалавров. – 4 е изд. – М.: Издательско-торговая корпорация «Дашков и К°», 2012. – 244 с. <https://yadi.sk/i/3_6xz0BcYyDB0w>  9 Эйсмонт Н. Г. Теоретические основы и практика научных исследований: учеб. пособие. – Омск: Изд-во ОмГТУ, 2018. – 98 с. <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** | **MAU-B43-1 - Siemens Automation Systems Development** |
| **Semester(s), in which the module is taught** | 8 |
| **Person, responsible for the module** | Senior Lecturer, MSc Asem Tursyngalievna Ibrasheva (Kazakh lang.)  Associate Professor, Candidate of Pedagogical Sciences Fedorenko Igor Anatolyevich (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with “National Instruments technologies in measurement and automation tasks”, “Schneider Electric automation systems development” |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation / Technical means of automation, Technical measuring instruments / Technological measurements and devices, Programming of digital technology and microcontrollers / PLC software, Microprocessor complexes in control systems / Basics of distributed control system, Building SCADA systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To give students basic knowledge and skills in the use of technology for industrial automation and software from Siemens to create automation and process control systems.  **LEARNING OUTCOMES:**  **Bachelor’s students know:**  the principles of measurement devices, actuators and control devices, network solutions devices of company Siemens, as well as the software;  **are able to:**  design the automated control system of technological process on the basis of hardware products of company Siemens, to program the control and monitoring system;  **COMPETENCES:**  - To demonstrate proficiency in the design of industrial automation systems using automation software and hardware;  - To demonstrate skills in analysis and synthesis of technological process;  - To master the methods of calculating the characteristics of hardware;  - To master modern computer technologies and software;  - To demonstrate skills in solving problems related to the selection of measuring devices, actuators, programmable controllers and related devices with appropriate characteristics of the company Siemens for a particular technological process. |
| **Content** | General information about Siemens industrial automation systems - Simatic. Functional and technical capabilities of Simatic controllers to solve automation and control automation tasks. Input/Output systems. Control systems. Software Simatic controllers and management in the software environment WinCC and Tia Portal. |
| **Current control** | Calculation graphic work 1,2, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Компьютерные технологии и микропроцессорные средства в автоматическом управлении/ Б.А. Карташов, А.С. Привалов, В.В. Самойленко и др.- Ростов-на/Д.: Феникс, 2013.- 540с. 2. Шишов О.В. Современные средства АСУ ТП : учебник / О.В. Шишов. - М. : Инфра-Инженерия; Вологда, 2021. - 532 с. 3. Калиниченко А. В. Справочник инженера по контрольно - измерительным приборам и автоматике : учеб. пособие / А.В. Калиниченко, Н.В. Уваров, В.В. Дойников. - 4-е изд., испр. и доп. - М.: Инфра-Инженерия, 2020; Вологда: 580 с. - 580 с. - (Высшее образование: Бакалавриат) 4. Молдабаева М.Н. Контрольно-измерительные приборы и основы автоматики: учеб. пособие / М.Н. Молдабаева. - М.: Инфра-Инженерия, 2019. - 332 с 5. Федоров Ю. Н. Справочник инженера по АСУТП: проектирование и разработка: в 2 т.: учеб.-практ. пособие. Т.1 / Ю.Н. Федоров. - М.: Инфра-Инженерия, 2018; Вологда. - 448 с.   Федоров Ю. Н. Справочник инженера по АСУТП: проектирование и разработка: в 2 т.: учеб.-практ. пособие. Т.2 / Ю.Н. Федоров. - М.: Инфра-Инженерия, 2018; Вологда. - 484 с. |

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| **Module name** | **MAС-B43-2 -** **Schneider Electric Automation Systems Development** |
| **Semester(s), in which the module is taught** | 8 |
| **Person, responsible for the module** | Professor, Candidate of Technical Sciences Kopesbaeva Aksholpan Auelbekovna (Kazakh lang.).  Associate Professor, Candidate of Technical Sciences Fedorenko Igor Anatolievich (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "National Instruments technologies in automation measurement tasks", "Siemens automation systems development". |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation / Technical means of automation, Programming of digital technology and microcontrollers / PLC software, Microprocessor complexes in control systems / Basics of distributed control system, Building SCADA systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** consolidation of knowledge, skills, and abilities in programming Schneider Electric controllers and designing automation systems for industrial facilities, using modern automation tools and software.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  technical and functional capabilities of Schneider Electric hardware and software for creating automation systems.  **are able to:** develop automation systems for industrial facilities based on Schneider Electric hardware and software.  **COMPETENCES:**  To utilize the technical capabilities of microprocessor technology, information receiving and transmitting equipment, and software products to solve automation problems.  To demonstrate experience in the design of automation systems based on modern technical and software tools.  To demonstrate the application of knowledge, skills and abilities in the implementation and operation of modern automation systems. |
| **Content** | General information about Schneider Electric industrial automation and control systems. Functional and technical capabilities of Modicon controllers for data acquisition, processing and control actions formation. Input/Output systems. control systems. Software Modicon controllers. Monitoring, control and Citect SCADA data acquisition system. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1.Управление в технических системах : учеб. пособие / А.А. Иванов, С.Л. Торохов. - М. : ФОРУМ, 2020. - 272 с. - (Высш.образование).  2.Разработка SCADA-систем : учеб. пособие / В.В. Кангин, М.В. Кангин, Д.Н. Ямолдинов. - М. : Инфра-Инженерия, 2019; Вологда. - 564с.: ил., табл.  3.Automation of standard technological processes: textbook / h.K. Koshimbaev S, B.A. Suleimenov; MES RK. - Almaty : BookPrint, 2016. - 266p  4.Автоматтандыру негіздері (Өндірісті цифрландыру) : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б.  5.Гуров В.В. Микропроцессорные системы: учебник. - М. : ИНФРА-М, 2016. - 336с. |

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| **Module name** | **MAС-B43-3 - National Instruments technologies in automation measurement tasks** |
| **Semester(s), in which the module is taught** | 8 |
| **Person, responsible for the module** | Associate Professor, Candidate of Technical Sciences Sagyndykova Sholpan Nazarovna (Kazakh lang.)  Professor, Candidate of Technical Sciences Khan Svetlana Gurievna (Russian lang) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective with "Siemens automation systems development", "Schneider Electric automation systems development" |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 90 hours  **Class hours:**  lectures -15; laboratory classes - 15; SSW – 54 (SSTS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology (in English); Mathematical basis of automation / Mathematical methods in automation issues; Technical measuring instruments / Technological measurements and devices; Elements and devices of automation / Technical means of automation; Basics of collecting and transmitting information |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to form students' knowledge in the field of National Instruments (NI) virtual instrumentation technology, which will allow the young specialist to improve, independently create a variety of instruments, measuring systems and automation software and hardware complexes, easily adapt them to changing requirements, reduce costs and time for their development.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  technology of virtual devices NI; basics of LabView graphical programming environment, digital signal processing and generation in LabView environment;  **are able to:** design and create virtual devices in LabView graphical programming environment.  **COMPETENCES:**  To demonstrate NI's virtual instrumentation technology toolkit, the LabView graphical programming environment;  To demonstrate experience creating computer models of measuring instruments, measurement and control systems;  To demonstrate application of their knowledge in implementing and complying with standards, be able to relate special technical problems to attitudinal and social issues. |
| **Content** | Acquainting students with National Instruments (NI) technologies for creating virtual instruments - creating computer models of measuring instruments, measuring and controlling systems, as well as with the tools of virtual instruments technology - LabView graphical programming environment. |
| **Current control** | Calculation graphic work1,2, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Тревис Дж. LabView для всех. – М.: ДМК Пресс, 2012. – 544 с. 2. Батоврин В.К., Бессонов А.С., Мошкин В.В., Папуловский В.Ф. LabView: практикум по основам измерительных технологий. – М.: ДМК Пресс, 2010. – 232 с.   Хан С.Г. Основы единства измерений и техническое регулирование. Учебное пособие. – Алматы: АУЭС, 2015. – 113 с. |

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| **Module name** | **MAС-B46 - Technological bases of heat energy production** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Lecturers:  Maxim Korobkov, Karlygash Olzhabaeva (Russian lang.)  Vera Orazalievna Baibekova, Karlygash Serikivna Olzhabaeva (Kazakh lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mathematics 1,2, Physics, Advanced physics / Special issues of physics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to form students' knowledge on the basic technological schemes of heat production sources; knowledge on the classification, types and designs of steam, hot-water and special boilers, the organization of combustion of organic fuels in the furnace devices of boilers, the basic calculation of basic and auxiliary equipment of thermal power plants, boiler rooms and heating systems.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - the methodology of determining the calorific value of energy fuel;  - methodology for determining the performance indicators of the main power equipment and heat generation sources;  - classification of power equipment of HPS and boiler houses;  - principles of operation of steam and hot-water boilers, steam and gas turbines;  - basic principles of operation of HPS heat supply systems and heat networks;  **are able to:**  - calculate heat loads of consumers;  - make basic calculations of power equipment;  - assess the efficiency of steam and hot-water boilers, cycles of steam and gas turbines;  **COMPETENCES:**  - To demonstrate proficiency in methods for calculating the thermal efficiency of boilers and turbines, methods for calculating the main performance indicators of HPS auxiliary equipment, analyzing the loss of operation in the main elements of the HPS cycle;  - To demonstrate possession of methods for assessing the efficiency of thermal schemes of HPSs and boiler-houses;  - To demonstrate knowledge of methods of HPS heat load selection methods for given categories of heat consumers. |
| **Content** | Methods of energy production and consumption. Ways of producing steam, Designs of power boilers. Operation of steam boilers, the principle of steam and gas turbines. Improvement of thermal cycles and processes HPS, heat (steam) HPS circuit, modes of operation and operation of HPS, heat supply systems, construction and operation. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, demonstration materials, 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. Кибарин А.А., Орумбаев Р.К., Ходанова Т.В. Котельные установки ТЭС: Учебное пособие. – Алматы: АУЭС, 2015. – 120 с.  3. Белоусов В.Н., Смородин С.Н., Смирнова О.С. Топливо и теория горения. Ч.I. Топливо: учебное пособие. – СПБГТУРП. – СПб: 2011., - 84с.  4. Мунц В.А., Котельные установки и парогенераторы: учебное пособие / В.А. Мунц, Е.Ю. Павлюк, А.С. Прошин. – М.: М-во науки и высш.обр. РФ. – Екатеринбург: Изд-во Урал. Ун-та, 2020. – 208с.  5. Липов Ю.М., Третьяков Ю.М. Котельные установки и парогенераторы. – Москва-Ижевск: НИЦ «Регулярная и хаотическая динамика», 2003. – 592 с.  6. Орумбаев Р.К., Кибарин А.А., Ходанова Т.В. Паровые и водогрейные котлы. Учебное пособие для ВУЗов. – М.: ИД Академия естествознания, 2017. – 320с.  7. Стерман Л.С., Лавыгин В.М., Тишин С.Г. Тепловые и атомные электрические станции. – М.: Издательство МЭИ, 2010.  8. Трухний А.Д. Парогазвые установки электростанций. Учебное пособие для вузов. — М.: МЭИ, 2013. — 648 с.: ил. |

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| **Module name** | **MAС-B47 - Energy saving and energy audit of the enterprise** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Lecturers:  Kibarin Andrey Anatolievich, Korobkov Maxim Sergeevich (Russian lang.).  Kasimov Arman Salemovich (Kazakh lang). |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **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 pre-requisites for joining the module** | Mathematics 1,2, Physics, Advanced physics / Special issues of physics, Technological bases of heat energy production |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of students' basic knowledge and ideas about the main directions of energy saving for different areas of industry; a minimum of knowledge on the basics of energy auditing of an industrial enterprise, taking into account its characteristics; ability and skills to determine the potential of energy saving and development of engineering solutions to improve energy efficiency.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - the structure of conducting energy audits of industrial facilities and systems;  - the methodology of conducting a documentary inspection of industrial facilities and systems;  - the methodology of instrumental inspection of industrial facilities and systems;  - the technology of compiling an energy passport of an industrial enterprise;  - the technology of developing measures for energy saving and energy efficiency of the industrial enterprise.  **are able to:**  - make basic calculations of energy resources consumption by an industrial enterprise;  - make up energy balances of the industrial enterprise, individual objects and systems;  - assess the efficiency of technological and energy equipment of an industrial enterprise;  - make calculations of energy saving measures.  **COMPETENCES:**  - To demonstrate proficiency in analyzing the results of documentary and instrumental inspections of industrial enterprises;  - To demonstrate the skills of planning energy audits;  - To demonstrate the skills of preparing energy-saving programs and calculating technical and economic indicators for the implementation of energy efficiency measures;  - To demonstrate skills in drawing up conclusions on energy audits of industrial enterprises. |
| **Content** | The concepts of energy conservation and energy efficiency. Conducting energy audits. Introduction of energy management system. Development of energy-saving programs. The legal framework and rules of energy audits. Development of measures for energy saving, the benefits of energy management system, the need for its implementation in a market economy. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, demonstration materials, laboratory facilities. |
| **References** | 1. Данилов Н.И., Щелоков Я.М. Энциклопедия энергосбережения. – Екатеринбург: Сократ, 2002.-352 с.  2. Научно-методические принципы энергосбережения и энергоаудита: Научное и учебно-методическое пособие: В 3-х т. - М.: Наука, 2005 г.  3. А.А. Арутюнян. Основы энергосбережения. – М.: ЗАО «Энергосервис», 2007. – 600 с.  4. Практическое пособие по выбору и разработке энергосберегающих проектов./ В семи разделах. Под общей редакцией О.Л. Данилова, П.А. Костюченко, 2006. - 668 с.  5. Борисова Н.Г. Энергосбережение в теплоэнергетике и теплотехнике. Учебное пособие Алматы: АИЭС, 2006.-119 с.  6. Учебное пособие/Т. Далсвен, Н. Г. Борисова, Л. А. Семёнова Научно-технические проблемы теплоэнергетики и теплотехники. Энергоаудит в Зданиях: Введение в Методы и Инструменты. АИЭС. Алматы, 2008 – 111 с.  7. Лисиенко В.Г.Хрестоматия энергосбережения в двух томах. -М.: Теплотехника, 2002.- 688с.  8. Практические рекомендации по использованию методов оценки экономической эффективности инвестиций в энергосбережение: Пособие для вузов / Н.Н. Кожевников, Н.С. Чинакаева, Е.В. Чернова. - М.: МЭИ, 2000. - 132с.  9. Приказ Министра по инвестициям и развитию Республики Казахстан от 31 марта 2015 года № 400. Зарегистрирован в Министерстве юстиции Республики Казахстан 22 июля 2015 года № 11729. «Об утверждении Правил проведения энергоаудита».  10. Методика по разработке энергетического паспорта объекта энергосбережения (утверждена приказом Председателя Комитета по государственному энергетическому надзору от 1 марта 2007 года № 1-П). |

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| **Module name** | **MAC-B48 - Automation of energy facilities** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Professor, PhD Zhussupbek Sarsenbek Seytbekovich (Kazakh lang.)  Senior lecturer Vladimir Pogrebnyak (Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mathematical basis of automation / Mathematical methods in automation issues, Metrology, standardization, certification and quality management/Metrology and measurements, Technical measuring instruments / Technological measurements and devices, Linear and non-linear automatic control systems, Elements and devices of automation / Technical means of automation |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  **acquisition by students:**  **-** basic knowledge of normative and methodical documents regulating the development process of systems and means of automation and control in power engineering;  - implementation of calculation and design of technical means of automation and control systems for industrial and technological processes in the field of energy;  - participation in development of automation projects, carrying out the choice of automation equipment, development of hardware and software automation systems;  - performing installation, adjustment and service maintenance of systems and technical means of automation**.**  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - ways of implementing technological processes, equipment in the energy industry;  - forecast socio-economic consequences of automation;  - improve the operational efficiency, quality of materials and finished products of automation from the perspective of the product life cycle;  - automation systems in thermal energy industry (boiler rooms, ASCE, etc.)  - the essence of Smart Grid technologies (automation in the electrical engineering);  - the essence of various automation networks and their interconnection.  **are able to:**  - perform collection, transformation, transfer of information flows in automation systems;  -produce synthesis of control systems for electric servo drives  - produce PLC programming;  - to choose the best standard hardware and software automation as a result of the feasibility study.  **COMPETENCES:**  - To demonstrate skills in working with multi-level branching automation systems, their components, and software;  - To demonstrate culture of thinking, ability to generalize, analyze, perceive information, set goals and select ways to achieve them;  - To strive for self-development, improvement of their qualification and skills;  - To demonstrate skills of adjustment of automation systems regulators, skills of work in automated workstations and SCADA-systems. |
| **Content** | Mathematical description of power engineering control objects. Statement of control and regulation tasks. Classification of control systems. Problems of power automation. Automatic regulators and their characteristics, indicators of quality control. Selecting the type and determining the parameters for setting regulators. Automation of basic and auxiliary processes. Calculation and adjustment of automatic control systems with different control loops. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | **Facilities for successful module implementation:**  Laboratory equipment, Personal computer, software. |
| **References** | 1. 1. Компьютерные технологии и микропроцессорные средства в автоматическом управлении/ Б.А. Карташов, А.С. Привалов, В.В. Самойленко и др.- Ростов-на/Д.: Феникс, 2013.- 540с:Системы автоматизации в газовой промышленности : учеб. пособие / М.Ю. Прахова, Э.А. Ша-ловников, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 480 с. 2. Шишов О.В., Современные средства АСУ ТП : учебник / О.В. Шишов.- М. : Инфра-Инженерия; Вологда, 2021. - 532 с. 3. Калиниченко А. В., Справочник инженера по контрольно - измерительным приборам и автоматике : учеб. пособие / А.В. Калиниченко, Н.В. Уваров, В.В. Дойников. - 4-е изд., испр. и доп. - М. : Инфра-Инженерия, 2020; Вологда: 580 с. - 580 с. - (Высшее образование: Бакалавриат) 4. 4.Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б. 5. 7. Автоматтандырылған жүйелерді жобалау. Дәрістер жинағы/құраст. Б.С.Джумагалиев.- Алматы: АЭжБУ, 2013.- 55б. 6. Юсупов Р.Х., Основы автоматизированных систем управления технологическими процессами : учеб. пособие / Р.Х. Юсупов. - М. : Инфра-Инженерия, 2018. - 132 с. 7. Скляр В.В., Обеспечение безопасности АСУТП в соответствии с современными стандартами : Метод.пособие / В.В. Скляр. - М. : Инфра-Инженерия, 2018. - 384 с. 8. Проектирование систем автоматизации [Текст] : Конспект лекций для студ.спец.5В070200-Автоматизация и управление / НАО АУЭС, Каф. инженерной кибернетики, сост.Б.С.Джумагалиев. - Алматы : АУЭС, 2013. - 63с 9. Программные средства систем автоматизации [Текст]: Метод. указ. к вып. лаб. раб. для студ. спец. 5В070200 - Автоматизация и управление / НАО АУЭС, Каф. автоматизации и управления, сост.: Л. К. Ибраева, Л. К. Абжанова, А.З. Ильясов.- Алматы: АУЭС, 2019.- 70 с 10. Певзнер, Л.Д. Теория систем управления: учеб.пособие. - 2-е изд., испр. и доп. - СПб. : Лань, 2013. - 424с: 11. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с: 12. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 13. Чикуров Н.Г., Моделирование систем и процессов : учеб. пособие / Н.Г. Чикуров. - М. : РИОР-Инфра-М, 2020. - 400 с. - (Высш.образование-Бакалавриат). |

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| **Module name** | **MAС-B49 - Automation systems software** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Senior Lecturer, MSc Shinar Kishikbayevna Adilova (Kazakh lang.)  Senior Lecturer Vladimir Pogrebnyak (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Linear and non-linear automatic control systems. Modeling and identification of control objects.  Programming of digital control technology and microcontrollers / PLC software.  Microprocessor complexes in control systems / Basics of distributed control systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of systematized knowledge in the field of computer-aided design and engineering calculations, acquisition by bachelor's students of practical skills of working with computer-aided design systems (CAD) and software tools.  **LEARNING OUTCOMES:** To develop schemes: automation, to use a variety of tools and applications, problems and prospects of software development  **Bachelor's students know:** basic concepts, principles of construction and technology of ACSPP design; methods of applying theoretical provisions for design.  **are able to:**  -apply programs and information processing tools.  -build schemes of functional interrelationships between departments using information technology.  **COMPETENCES:**  - the ability and willingness to master the basic methods, ways and means of obtaining, storing, processing information, use the computer as a means of working with information;  - the ability to use modern information technologies, to manage information using applications; to use network computer technology, databases and application packages in their subject area. |
| **Content** | Basic concepts of process control. Automated control systems TP and P. Engineering analysis of automation of technological processes and industries. Automated design of automation systems of technological processes. Development of software automation tools. Division of labor in creating software automation tools. Custom and specialized software automation tools. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Гудвин, Г.К.Проектирование систем управления / Г.К. Гудвин, С.Ф. Гребе, М.Э. Сальгадо; пер.с англ.А.М.Епашникова. - М. : БИНОМ.Лаб.знаний, 2012  2. Целищев Е.С., Автоматизация проектирования технического обеспечения АСУТП : учеб. пособие / Е.С. Целищев, А.В. Котлова, И.С. Кудряшов. - М. : Инфра-Инженерия, 2019. - 195 с.  3. Шыңғысов, Б.Т. Автоматтандырылған жобалау жүйелерінің негіздері : оқулық - Алматы : Лантар Трейд, 2019.  4. Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б.   1. [www.avtomatica.ru/](http://www.avtomatica.ru/) 2. 2.[www.kipia.ru/](http://www.kipia.ru/)   3.[www.tecon.ru/](http://www.tecon.ru/) |

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| **Module name** | **MAС-B50 - Diagnostics of thermal power facilities and control systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Orakbaev Yerbol Zhumageldievich (Kazakh lang.)  Mukhanov Bakhyt Kaskabaevich, Professor, PhD (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Technological bases of heat energy production, Energy saving and energy audit of the enterprise, Automation of energy facilities |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Tostudy technologies, methods and means of technical diagnosis as a means of improving the efficiency and reliability of the objects of technology in the design and operation, troubleshooting, as well as means of technical diagnosis and control of the technical condition of heat power equipment and features of their design in modern automation systems  **LEARNING OUTCOMES:** To get information about hardware and software tools and methods of diagnosis, to learn how to use the method of assessing the residual life of equipment and troubleshooting information by automated systems of technical diagnostics (ASTD) and monitoring, to learn how to evaluate the effectiveness of ASTD in the overall structure of the APCS  **Bachelor's students know:**  - peculiarities of information support of high-level enterprises, modern systems of control and automation of software and hardware diagnostics of modern production technologies;  - the formation of the reliability of equipment and its components;  - methods of automatic control systems, including the reliability of equipment used to design and compensate the work cycle;  - methods of calculating the reliability of control systems.  are able to:  - create a functional and algorithmic structure of automated technical diagnostic systems for specific diagnostic objects.  - develop and optimize the structure of automated systems of technical diagnostics for operational and post-operational diagnostics, including the assessment of the residual life of equipment.  COMPETENCES:  - to demonstrate the willingness to participate in the development of design and working technical documentation, execution of completed design and development work in accordance with standards, specifications, and other regulatory documents;  - to demonstrate the ability to conduct experiments according to a given methodology and analyze the results using the appropriate mathematical apparatus. |
| **Content** | The concept and tasks of diagnostics. Classification and description of emergency and non-emergency situations. Types of quantitative indicators of systems reliability, devices and equipment. Methods of technical and analytical assessment of their condition, conducting diagnostic tests. The choice of optimal levels of reliability at the stage of system design. The application of methods and means of technical diagnostics in determining the location and causes of faults in objects. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment, |
| **References** | 1. А.С. Әбілдаева, Басқару жүйесінің сенімділігі мен диагностикасы: Oқу кұралы. – Тараз: Тараз университеті, 2018. – 88 б. 2. Цой А.П., Әділбеков М.Ә. Технологиялык машиналардын сенімділігі. Оку кұралы/. Алматы: АТУ, 2018 Ж.-1226. 3. Евгений Б. Надежность и техническая диагностика систем. Учебное пособие : Издательство Лань, 2019. — 260 с. 4. Шишмарёв, В. Ю.  Диагностика и надежность автоматизированных систем : учебник для вузов / В. Ю. Шишмарёв. — 2-е изд. — Москва : Издательство Юрайт, 2020. — 341 с.. 5. <http://docs.cntd.ru/document/1200009412/> ГОСТ 24.701-86. Надежность автоматизированных систем управления. Основные положения   [http://docs.cntd.ru/document/gost-27-301-95 /](http://docs.cntd.ru/document/gost-27-301-95%20/) Межгосударственный стандарт. Надежность в технике. Расчет надежности. Основные положения |

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| **Module name** | **MAС-B51 - Methods for protecting equipment of automated systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Senior Lecturer Kalyshev Nurgazy Nurabilovich (Kazakh lang.)  Senior Lecturer Vladimir Pogrebnyak (Russian lang.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Theoretical basis of electrical engineering  Elements and devices of automation / Technical means of automation Automation of energy facilities  Systems of industrial pneumoautomatics and electropneumoautomatics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To acquire theoretical and practical knowledge and skills in the calculation, design and application of relay protection and automation for electrical equipment and power supply systems of automated industries.  **LEARNING OUTCOMES:** knowledge of theoretical methods and practical ways of calculation and design, as well as the use of relay protection and automation for electrical equipment and power supply systems of automated industries.  **Bachelor’s students know:**  - methods of relay protection theory and automation of electrical equipment and power supply systems of automated industries;  - principles of functioning of relay protection and automation devices, methods of their application and adjustment of their parameters;  - methods of designing and calculation of operation parameters of relay protection devices and automatics  - ways of modeling relay protection and automation devices and their functioning in modern software environments;  **are able to:**  - choose the type and devices of relay protection and automation for a particular object in the electric power system of automated productions;  - design relay protection and automation devices in electric power systems and calculate parameters of their operation  - simulate relay protection and automation devices and their functioning in modern software environments;  COMPETENCES:  - To demonstrate proficiency in methods and techniques of relay protection and automation of facilities in electrical systems of automated industries;  - To demonstrate proficiency in selecting the type and devices of relay protection and automation, designing and calculating the parameters of their operation;  - To demonstrate the skills of modeling devices of relay protection and automation and their functioning in modern software environments. |
| **Content** | General provisions and classification of industrial hazards. Organization of safety systems and methods of equipment protection of automation objects. Regulatory and technical base for the development of safety systems of industrial facilities. The main resources and technical solutions to ensure safety on the basis of technical systems and automation equipment. Features of the design of safety systems and protection of equipment at automation facilities. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Андреев В.А. Релейная защита и автоматика систем электроснабжения: учебник для вузов. – М.: Высш. шк., 2006. – 639 с.  2. Андреев В.А. Релейная защита систем электроснабжения в примерах и задачах: учеб. пособие. – М.: Высш. шк., 2008. – 252 с.  3. Евминов Л.И., Селиверстов Г.И. Релейная защита и автоматика систем электроснабжения: учеб.-метод. пособие. – Гомель: Гомел. гос. техн. ун-т им. П.О. Сухого, 2016. – 531 с.  4. Надеин В.Ф., ПетуховС.В., Радюшин В.В. Релейная защита и автоматика в системах электроснабжения: учеб. пособие. – Архангельск: Изд-во Северного (Арктического) федерального ун-та им. М.В. Ломоносова, 2015. – 100 с.  5. Фигурнов Е.П. Релейная защита: учебник. – К.: Транспорт Украины. – 2004. – 565 с.  6. Мельников М.А. Релейная защита и автоматика элементов систем электроснабжения промышленных предприятий: учеб. пособие. – Томск: Изд-во Томск. политехн. унив-та, 2008. - 218 с.  7. Ершов А.М. Релейная защита и автоматика в системах электроснабжения. Часть 1. Токи короткого замыкания: учеб. пособие. – Челябинск: Изд. центр ЮУрГУ, 2011. – 168 с.  8. <https://faultan.ru/simulation/relay_protection/relay_library/> |

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| **Module name** | **MAС-B52 - Technology of production, preparation and storage of commercial oil** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Associate Professor. Abildinova S.K. (Russian lang.), (Kazakh lang.)  Associate Prof. Idrisova K.S. (English lang.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; practical classes -30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 4 |
| **Required and recommended pre-requisites for joining the module** | Physics, Advanced Physics / Special issues of Physics |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of a set of knowledge of bachelor's students to use the theoretical bases of preparation processes and transportation of oil to refineries, to master practical skills in the field of modern technologies of production preparation and storage of marketable oil.  **LEARNING OUTCOMES:**  **Bachelor's student know:**  **-** The purpose and composition of collecting systems  - factors influencing the choice of an oil and gas collecting system;  - advantages and disadvantages of a sealed collecting system;  - modern technologies of oil and gas production and treatment;  - modern technologies of oil preparation for transportation.  **are able to:**  **-** make schematic diagrams of the collection and transport of well products in the field;  - develop systems for collecting and intra-field transport of oil and gas in the fields;  - use up-to-date scientific, technical, reference literature and normative documents for describing technological processes.  **COMPETENCES:**  - To demonstrate proficiency in methods of selecting rational directions of modern oil and gas production technologies and their preparation for transportation;  - To demonstrate the methods of selecting equipment to implement the appropriate oil and gas production technology;  - carry out the selection of equipment in accordance with the technology of preparation of oil and gas for transportation. |
| **Content** | Collection and preparation of well products of oil fields. Technologies for separation of downhole products by means of multifunctional separation, degassing, dewatering, desalting by means of an electrostatic dehydrator. Pipelines of oil, oil gas and water collection systems of oil fields. Transportation of oil. Technology of low-temperature processes. Tanks for storage of crude and commercial oil, depressor additives, and other liquids. |
| **Current control** | Calculation graphic work 1, midterm control 2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Регулярные процессы и оборудование в технологиях сбора, подготовки и переработки нефтяных и природных газов / Е.П. Запорожец, Д.Г. Антониади, Г.К. Зиберт и др. – Краснодар: Издательский Дом – ЮГ, 2012. – 620 с.  2. Глущенко В.Н. Нефтепромысловая химия: учебное пособие: в 5 т. / В.Н. Глущенко М.А. Силин; под ред. И.Т. Мищенко. – М.: Интерконтакт Наука, 2009-2010. Т. 5: Предупреждение и устранение асфальтеносмолопарафиновых отложений. – 2009. – 475 с.  3. Ишмурзин А.А. Нефтегазопромысловое оборудование: учебник / А.А. Ишмурзин; Уфимский государственный нефтяной технический университет (УГНТУ). – Уфа: Изд-во УГНТУ, 2008. – 565 с.  1. Лутошкин Г.С. Сборник задач по сбору и подготовке нефти, газа и воды на промыслах: учебное пособие для вузов / Г.С. Лутошкин, И.И. Дунюшкин. – Москва: Альянс, 2007. – 135 с.  2. Сбор, подготовка и хранение нефти и газа. Технологии и оборудование: учебное пособие / Р.С. Сулейманов [и др.]; Уфимский государственный нефтяной технический университет (УГНТУ). – Уфа: Нефтегазовое дело, 2007. – 447 с.  3. Лутошкин Г.С. Сбор и подготовка нефти, газа и воды: учебник для вузов / Г.С. Лутошкин. – Москва: АльянС, 2005. – 319 с.  4. Дунюшкин И.И. Сбор и подготовка скважинной продукции нефтяных месторождений: учебное пособие / И.И. Дунюшкин. – Москва: Нефть и газ, 2006. – 320 с.  http://www.twirpx.com.  http://www.chem.msu.su/cgi-bin/tkv.pl.  http://www.sciteclibrary.ru/. |

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| **Module name** | **MAС-B53 - Automation of technological processes of production, preparation and transportation of oil** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Zhussupbekov Sarsenbek Seytbekovich (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, course project, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **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 pre-requisites for joining the module** | Mathematical basis of automation / Mathematical methods in automation issues, Metrology, standardization, certification and quality management/Metrology and measurements, Technical measuring instruments / Technological measurements and devices, Technology of production, preparation and storage of commercial oil, Elements and devices of automation / Technical means of automation |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to acquire basic knowledge on composition and functions of automation systems in the oil and gas industry, the principles of construction of automatic control and regulation systems, the types and principles of the technical means of automation.  **LEARNING OUTCOMES:**  Bachelor's students know:  - technological processes of the industry: classification, basic equipment and apparatuses, principles of functioning, technological modes and quality indicators of functioning, methods of calculation of the main characteristics, optimal modes of operation;  - methods for analyzing technological processes and equipment for their implementation, as automation and control objects;  - controllable output variables, controlling and regulating actions, static and dynamic properties of technological control objects  - technological control objects of the industry; structural schemes of construction, modes of operation, mathematical models of industries as objects of control; technical and economic criteria for the quality of functioning and objectives of control;  - basic automation schemes of typical technological objects of industry;  - structures and functions of automated control systems.  are able to:  - perform analysis of technological processes and equipment as objects of  perform analysis of technological processes and equipment as objects of automation and control  - make structural diagrams of productions, their mathematical models as objects of control, determine the quality criteria of functioning and control objectives;  - choose a functional automation scheme for a given technological process.  COMPETENCES:  - To possess the culture of thinking, be able to generalize, analyze, perceive information, set the goal and the choice of ways to achieve it;  - to aspire to self-development, improvement of his/her qualification and skill;  - to be able to perform work on the automation of technological processes and  capable of performing work on automation of technological processes, providing them with means of automation and control; to use modern methods and means of automation, control, diagnostics, testing and control of processes, product life cycle and its quality;  - to be able to develop design and working technical documentation in the field of automation of technological processes and productions, management of the life cycle of products and its quality, to formalize the completed design and engineering works. |
| **Content** | Elements, structure, types and functions of automation systems in the oil industry. Methods and means of automation of the oil well. Automation of downhole pumping units, electric centrifugal pumps, group metering units, booster pump stations. Automation of complex oil treatment. Control objects of the main pipeline. Trunk oil pipelines (TOP).  Tasks and functions of TPL. TPL operating modes. Automation scheme of the pumping unit at the pumping station. The scheme of pressure control at the inlet and outlet of the intermediate oil pumping station. Automatic protection of oil pipelines from overloads. Automation scheme to protect the oil pipeline during transients at the oil pumping station and pressure waves in the oil pipeline. Booster pump station (BPS). Purpose and technological process of booster pump station. Scheme for regulating the performance of booster pump station. Tasks and functions of the automation system in controlling the process of in-field oil pumping. Scheme of automation of the first stage separator. Scheme of gas separator automation at booster pump station Automation of oil pumping stations. Automation of tank farms and commercial accounting of oil. |
| **Current control** | Calculation graphic work 1,2,3, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment. |
| **References** | 1. Системы автоматизации в нефтяной промышленности : учеб. пособие / М.Ю. Прахова, Е.А. Хорошавина, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 304 с. 2. Системы автоматизации в газовой промышленности : учеб. пособие / М.Ю. Прахова, Э.А. Ша-ловников, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 480 с. 3. Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б. 4. Автоматтандырылған жүйелерді жобалау. Дәрістер жинағы/құраст. Б.С.Джумагалиев.- Алматы: АЭжБУ, 2013.- 55б. 5. Юсупов Р.Х., Основы автоматизированных систем управления технологическими процессами : учеб. пособие / Р.Х. Юсупов. - М. : Инфра-Инженерия, 2018. - 132 с. 6. Скляр В.В., Обеспечение безопасности АСУТП в соответствии с современными стандартами : Метод.пособие / В.В. Скляр. - М. : Инфра-Инженерия, 2018. - 384 с. 7. Проектирование систем автоматизации [Текст] : Конспект лекций для студ.спец.5В070200-Автоматизация и управление / НАО АУЭС, Каф. инженерной кибернетики, сост.Б.С.Джумагалиев. - Алматы : АУЭС, 2013. - 63с 8. Программные средства систем автоматизации [Текст]: Метод. указ. к вып. лаб. раб. для студ. спец. 5В070200 - Автоматизация и управление / НАО АУЭС, Каф. автоматизации и управления, сост.: Л. К. Ибраева, Л. К. Абжанова, А.З. Ильясов.- Алматы: АУЭС, 2019.- 70 с 9. Певзнер, Л.Д. Теория систем управления: учеб.пособие. - 2-е изд., испр. и доп. - СПб. : Лань, 2013. - 424с: 10. Певзнер Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с: 11. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 12. Чикуров Н.Г. Моделирование систем и процессов : учеб. пособие / Н.Г. Чикуров. - М. : РИОР-Инфра-М, 2020. - 400 с. - (Высш.образование-Бакалавриат). |

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| **Module name** | **MAС-B54 - Processes and apparatus for oil refining** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Associate Professor. Abildinova S.K. (Russian lang.), (Kazakh lang.)  Associate Prof. Idrisova K.S. (English lang.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; practical classes -30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Physics, Advanced physics / Special issues of physics, Technology of production, preparation and storage of commercial oil |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of a body of knowledge for bachelor's students to use the theoretical bases of oil refining processes of different types in production, to have a clear understanding of the composition and properties of the main types of commercial petroleum products, to master practical skills for the separation and basic physical and chemical methods of analysis of oils and petroleum products.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  **-** basic physical and chemical laws of oil and gas refining;  - basic technological processes used in modern  oil refining and petrochemicals;  - basic schemes and types of oil refineries, their characteristics, classification and relationship between the individual elements of these schemes;  - basics of the theory of gas-phase thermal reactions and thermodynamic basics of hydrocarbon formation and cleavage.  **are able to:**  **-** draw up material and energy balances of oil refining processes, its stages and individual apparatuses;  - assess the perfection of the technology on the basis of basic efficiency criteria;  - solve typical problems in calculating the material balances of technological processes of oil refining;  - use modern scientific and technical, reference literature and normative documents to describe technological processes.  **COMPETENCES:**  **-** To demonstrate mastery of methods of selecting rational directions of oil refining and possible assortments of obtained commodity and intermediate products;  - to select the basic technological scheme of the process, depending on its capacity, the direction of refining of raw materials and the range of products obtained;  - to demonstrate knowledge of methods for determining the optimal (rational) parameters of the technological mode of the main apparatus and equipment of technological processes. |
| **Content** | General information about oil refining. Classification of refining processes of petroleum products. The current state and current problems of oil refining. Brief characteristics and classification of refineries. The elemental and fractional composition of oil. Technology of primary oil refining. Fractionation. Distillation and rectification of oil. Industrial installations of atmospheric and vacuum oil distillation. Fractionation of hydrocarbon gases of oil refining. Rectification columns, heat exchange equipment. |
| **Current control** | Calculation graphic work 1, midterm control 2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Технология переработки нефти и газа. В 2-х ч. /Под редакцией О.Ф. Глаголевой, В.М. Капустина. – М.: Колос, 2005. - 400с. 2. Бишимбаева Г. К., Букетова А.Е. Химия и технология нефти и газа. – Алматы.: Бастау, 2007. -280с. 3. Владимиров А. И., Молоканов Ю. К., Скобло А.И., Щелкунов В.А. 4. Процессы и аппараты нефтегазопереработки и нефтихимии. - Издание: 5. РГУ нефти и газа имени И.М.Губкина, Москва, 2012 г., 725 с. 6. Агабеков, Нефть и газ. Технологии и продукты переработки [Текст]: монография /, – Ростов-на-Дону: Феникс, 2014. – 459 с. 7. Рябов, В. Д. Химия нефти и газа [Текст]: Учебное пособие.- Москва : ИД "ФОРУМ" : ИНФРА-М, 2014. - 334 с. 8. Павлов К.Ф., Романков П.Г., Носков А.А. Примеры и задачи по курсу 9. процессов иаппаратов химической технологии. – 13-е изд. стериотипное. – М.: Альянс, 2006. – 576с. 10. Современный нефтехимический комплекс и проектирование нефтехимических предприятий: электронное учебное пособие / С.О. Подгорный, О.Т. Подгорная, Е.Д.Скутин, А.Г. Нелин, С.В. Корнеев - Омск: Изд-во Ом ГТУ, 2015. - 118 с. 11. http://www.twirpx.com. 12. http://www.chem.msu.su/cgi-bin/tkv.pl. 13. http://www.sciteclibrary.ru/. |

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| **Module name** | **MAС-B55 - Automation of petrochemical production processes** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Zhussupbekov Sarsenbek Seytbekovich (Kazakh, Russian languages) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lecture, laboratory works, course paper, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Technology of production, preparation and storage of commercial oil, Automation of technological processes of production, preparation and transportation of oil, Processes and apparatus for oil refining |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to acquire basic knowledge of the composition and functions of automation systems in petrochemical production, the principles of automatic control and regulation systems, the types and principles of the technical means of automation.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - regularities of the course of industrial chemical reactions, physical and chemical bases of hydrocarbon processing technologies, modern requirements for oil refining products;  - basic chemical processing equipment (machines and devices), as well as the physical and chemical laws of the processes that occur in them (hydromechanical, thermal, mass exchange, chemical);  - the most common industry applied software packages for the calculation and design of chemical-technological processes, equipment, production automation and economic optimization.  **are able to:**  - determine optimal equipment operation parameters for various chemical-technological processes;  - carry out technological process in accordance with the regulations and to use technical means for measuring the basic parameters of technological process,  properties of raw materials and products.  **COMPETENCES:**  - to master the basic methods, ways and means of obtaining, storing, processing information, the skills of working with a computer as a means of information management;  - to master the ability to use modern information technologies for calculation of technological parameters of equipment and monitoring of technological processes.  - to apply analytical and numerical methods for solving assigned tasks, use modern information technologies, conduct information processing with the use of applied software tools;  - to make specific technical decisions in the development of technological processes, choose technical means and technologies, taking into account the environmental consequences of their application  - to identify and eliminate deviations from the modes of operation of technological equipment and technological process parameters. |
| **Content** | Modern state, tasks, methods and means of automation of refining and petrochemical facilities. Control of processes of primary oil refining, catalytic cracking, diesel fuel hydrotreating, delayed coking. Automation of sulfuric acid alkylation, butylene and butadiene dehydrogenation, gas fractionation, phenol selective purification of oil. Automation of catalytic reforming processes. Automation of refinery and petrochemical productions. Automation of pyrolysis unit. |
| **Current control** | Course paper, midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. 1. Системы автоматизации в нефтяной промышленности : учеб. пособие / М.Ю. Прахова, Е.А. Хорошавина, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 304 с. 2. Системы автоматизации в газовой промышленности : учеб. пособие / М.Ю. Прахова, Э.А. Ша-ловников, А.Н. Краснов и др.; под. ред. М. Ю. 3. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 480 с. 3. Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б. 4. 4.Автоматтандырылған жүйелерді жобалау. Дәрістер жинағы/құраст. Б.С.Джумагалиев.- Алматы: АЭжБУ, 2013.- 55б. 5. Юсупов Р.Х., Основы автоматизированных систем управления технологическими процессами : учеб. пособие / Р.Х. Юсупов. - М. : Инфра-Инженерия, 2018. - 132 с. 6. Скляр В.В., Обеспечение безопасности АСУТП в соответствии с современными стандартами : Метод.пособие / В.В. Скляр. - М. : Инфра-Инженерия, 2018. - 384 с. 7. Проектирование систем автоматизации [Текст] : Конспект лекций для студ.спец.5В070200-Автоматизация и управление / НАО АУЭС, Каф. инженерной кибернетики, сост.Б.С.Джумагалиев. - Алматы : АУЭС, 2013. - 63с 8. Программные средства систем автоматизации [Текст]: Метод. указ. к вып. лаб. раб. для студ. спец. 5В070200 - Автоматизация и управление / НАО АУЭС, Каф. автоматизации и управления, сост.: Л. К. Ибраева, Л. К. Абжанова, А.З. Ильясов.- Алматы: АУЭС, 2019.- 70 с 9. 9. Певзнер, Л.Д. Теория систем управления: учеб.пособие. - 2-е изд., испр. и доп. - СПб. : Лань, 2013. - 424с: 10. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с: 11. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 12. Чикуров Н.Г., Моделирование систем и процессов : учеб. пособие / Н.Г. Чикуров. - М. : РИОР-Инфра-М, 2020. - 400 с. - (Высш.образование-Бакалавриат). |

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| **Module name** | **MAC-B56 - Reliability and safety of automation systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Sarsenbek Seytbekovich Zhusupbekov (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information security in control systems, Systems of industrial pneumoautomatics and electropneumoautomatics, Automation of technological processes of production, preparation and transportation of oil, Microprocessor complexes in control systems / Basics of distributed control systems. |
| **Module objectives/intended learning outcomes** | **MODULE AIM: to** form students' knowledge about analysis and synthesis of technical (technological) automated systems with a given level of reliability and their diagnosis.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - functional and numerical indicators of reliability and maintainability of technical and software elements and systems;  - methods of (calculation) reliability analysis of automated software and hardware systems;  - methods for analyzing technical efficiency of complex automated systems;  - methods of diagnosing technical and software systems;  **are able to:**  - determine estimates of reliability and maintainability of technical elements and systems based on the results of tests and observations;  - analyze reliability of local technical (technological) systems;  - synthesize local technical systems with a given level of reliability;  - diagnose reliability indicators of local technical systems.  **COMPETENCES:**  - to demonstrate approaches and procedures mastery necessary to create reliable technical systems and automation software;  - to have knowledge of the structure and composition of their diagnostics;  - to demonstrate proficiency in the development of reliability and security of automation systems. |
| **Content** | Reliability and safety of control systems of oil production. The principles of description, methods of assessment and ways to ensure reliability and safety. Methods for diagnosing and controlling leaks. Levels of dangerous events prevention and minimizing their consequences. Ensuring safety at the field level. Emergency protection systems. Industrial safety standards and definition of its functional indicators. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Системы автоматизации в нефтяной промышленности : учеб. пособие / М.Ю. Прахова, Е.А. Хорошавина, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 304 с. 2. Системы автоматизации в газовой промышленности : учеб. пособие / М.Ю. Прахова, Э.А. Ша-ловников, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 480 с. 3. Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б. 4. Автоматтандырылған жүйелерді жобалау. Дәрістер жинағы/құраст. Б.С.Джумагалиев.- Алматы: АЭжБУ, 2013.- 55б. 5. Юсупов Р.Х., Основы автоматизированных систем управления технологическими процессами : учеб. пособие / Р.Х. Юсупов. - М. : Инфра-Инженерия, 2018. - 132 с. 6. Скляр В.В., Обеспечение безопасности АСУТП в соответствии с современными стандартами : Метод.пособие / В.В. Скляр. - М. : Инфра-Инженерия, 2018. - 384 с. 7. Проектирование систем автоматизации [Текст] : Конспект лекций для студ.спец.5В070200-Автоматизация и управление / НАО АУЭС, Каф. инженерной кибернетики, сост.Б.С.Джумагалиев. - Алматы : АУЭС, 2013. - 63с 8. Программные средства систем автоматизации [Текст]: Метод. указ. к вып. лаб. раб. для студ. спец. 5В070200 - Автоматизация и управление / НАО АУЭС, Каф. автоматизации и управления, сост.: Л. К. Ибраева, Л. К. Абжанова, А.З. Ильясов.- Алматы: АУЭС, 2019.- 70 с 9. Певзнер, Л.Д. Теория систем управления: учеб.пособие. - 2-е изд., испр. и доп. - СПб. : Лань, 2013. - 424с: 10. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с: 11. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с 12. Чикуров Н.Г., Моделирование систем и процессов : учеб. пособие / Н.Г. Чикуров. - М. : РИОР-Инфра-М, 2020. - 400 с. - (Высш.образование-Бакалавриат). |

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| **Module name** | **MAC-B57 - Process control systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Zhusupbekov Sarsenbek Seitbekovich (kaz, rus.) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Linear and non-linear automatic control systems, Modeling and identification of control objects, Automation of technological processes of production, preparation and transportation of oil |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** mastering the principles and methods of building automated control systems for technological processes of oil production using modern technical means.  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - fundamentals of the control of technical systems theory;  - functional purpose of technical means that are part of automatic regulation and control systems;  - principles of construction and operation of automated control and regulation systems;  - basic methods and technical means of automation of standard production processes.  **are able to:**  - analyze technological process as a control object;  - analyze schemes of automatic control and management of production processes;  - use modern technical means of automation and control.    **COMPETENCES:**  - to have a culture of thinking, the ability to generalize, analyze, perceive information, set a goal and choose ways to achieve it;  - to strive for self-development, improvement of their qualifications and skills;  - to demonstrate the ability to perform work on the automation of technological processes and production, their provision with automation and control tools;  - to use modern methods and means of automation, control, diagnostics, testing and management of processes, product life cycle and its quality;  - to demonstrate the skills of reading control schemes of technical systems;  - to use deep theoretical and practical knowledge in the development of control schemes for technical systems. |
| **Content** | Principles, tasks of managing objects of the oil "life cycle". Physical foundations of mathematical models: laws of conservation of mass, energy, momentum and thermodynamic functions, laws of mass and energy transfer. Models of control objects - tanks, pipelines, separation plants. Models of chemical, hydromechanical, thermal, mass transfer processes. Application of analytical, regression and adaptive models of chemical-technological processes for the purposes of optimal control. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Системы автоматизации в нефтяной промышленности : учеб. пособие / М.Ю. Прахова, Е.А. Хорошавина, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 304 с. 2. Системы автоматизации в газовой промышленности : учеб. пособие / М.Ю. Прахова, Э.А. Ша-ловников, А.Н. Краснов и др.; под. ред. М. Ю. Праховой. - М. : Инфра-Инженерия, 2019; Вологда. - 480 с. 3. Кошимбаев, Ш.К. Автоматтандыру негіздері (Өндірісті цифрландыру) [Мәтін] : оқу құралы / Ш.К. Кошимбаев, Б.А. Сулейменов, У.Н. Иманбекова; ҚР БҒМ, Satbayev university. - Алматы : Шикула, 2020. - 324 б. 4. Автоматтандырылған жүйелерді жобалау. Дәрістер жинағы/құраст. Б.С.Джумагалиев.- Алматы: АЭжБУ, 2013.- 55б. 5. Юсупов Р.Х., Основы автоматизированных систем управления технологическими процессами : учеб. пособие / Р.Х. Юсупов. - М. : Инфра-Инженерия, 2018. - 132 с. 6. Скляр В.В., Обеспечение безопасности АСУТП в соответствии с современными стандартами : Метод.пособие / В.В. Скляр. - М. : Инфра-Инженерия, 2018. - 384 с. 7. Проектирование систем автоматизации [Текст] : Конспект лекций для студ.спец.5В070200-Автоматизация и управление / НАО АУЭС, Каф. инженерной кибернетики, сост.Б.С.Джумагалиев. - Алматы : АУЭС, 2013. - 63с 8. Программные средства систем автоматизации [Текст]: Метод. указ. к вып. лаб. раб. для студ. спец. 5В070200 - Автоматизация и управление / НАО АУЭС, Каф. автоматизации и управления, сост.: Л. К. Ибраева, Л. К. Абжанова, А.З. Ильясов.- Алматы: АУЭС, 2019.- 70 с 9. Певзнер, Л.Д. Теория систем управления: учеб.пособие. - 2-е изд., испр. и доп. - СПб. : Лань, 2013. - 424с: 10. Певзнер, Л.Д. Теория автоматического управления. Задачи и решения : учеб.пособие. - СПб.: Лань, 2016. - 604с: 11. Васильков Ю.В., Математическое моделирование объектов и систем автоматического управления : учеб. пособие / Ю.В. Васильков, Н.Н. Василькова. - М.; Вологда: Инфра-Инженерия, 2020. - 428с   12.Чикуров Н.Г., Моделирование систем и процессов : учеб. пособие / Н.Г. Чикуров. - М. : РИОР-Инфра-М, 2020. - 400 с. - (Высш.образование-Бакалавриат). |

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| **Module name** | **MAC-B58 - Innovation Management and Marketing** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Senior Lecturer Tulegenova Saule Kuanyshevna, (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -30; practice - 15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mathematics 1, Mathematics 2 |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** formation of a set of knowledge, abilities and skills of management of innovative activity of the enterprise or division.  **LEARNING OUTCOMES:**  **Bachelor's students must know:**  **-** specifics of formation and implementation of innovative strategies, composition and structure of innovative projects and programs, methods of assessment of their investment attractiveness, methods of examination of innovative projects;  - stages, sequence and system of management of creation, development and quality of innovative products at all stages of their life cycle;  - a variety of organizational forms of innovation, the essence of the value bases in the management of human resources organization, necessary for the complex transformation and forecasting of business processes of enterprises on the basis of reengineering;  **are able to**:  -evaluate the investment attractiveness of innovative projects;  -demonstrate skills to adequately apply the acquired knowledge with concrete examples in seminars.  - form specific analytical notes on the markets of the latest technologies and evaluate the prospects of the domestic scientific and technological sphere and its place in the international technological cooperation;  **COMPETENCES:**  - to demonstrate the skills to carry out the examination of innovative projects;  - to demonstrate skills in choosing the best option for the development of an organization or enterprise in the field of innovation;  - to use deep theoretical and practical knowledge in the field of analysis of innovative activity of an enterprise or division. |
| **Content** |  |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Енин, Ю. И. Инновационный менеджмент и маркетинг инноваций : курс лекций / Ю. И. Енин, А. А. Пилютик, Н. А. Подобед. - Минск : Право и экономика, 2017. - 115 с. http://edoc.bseu.by:8080/handle/edoc/69753 2. Агарков, А. П. Управление инновационной деятельностью : Учебник для использования в образовательном процессе образовательных организаций, реализующих программы высшего образования по направлениям подготовки «Менеджмент», «Инноватика» (уровень бакалавриата) / А. П. Агарков, Р. С. Голов. – 2-е издание. – Москва : Издательско-торговая корпорация «Дашков и К», 2020. – 204 с. 3. Алексеев, А. А. Инновационный менеджмент : учебник и практикум для вузов / А. А. Алексеев. – 2-е изд., перераб. и доп. – Москва : Издательство Юрайт, 2021. – 259 с. 4. Алексеева, М. Б. Анализ инновационной деятельности : учебник и практикум для вузов / М. Б. Алексеева, П. П. Ветренко. – Москва : Издательство Юрайт, 2021. – 303 с. 5. Баранчеев, В. П. Управление инновациями : учебник для академического бакалавриата / В. П. Баранчеев, Н. П. Масленникова, В. М. Мишин. – 3-е изд., перераб. и доп. – Москва : Издательство Юрайт, 2019. – 747 с. 6. Беляев, Ю. М. Инновационный менеджмент : учебник для бакалавров / Ю. М. Беляев. – 2-е изд., стер. – Москва : Издательско-торговая корпорация «Дашков и К°», 2020. – 218 с. 7. Боева, А. А. Методы инновационного менеджмента предприятия в условиях рыночной экономики / А. А. Боева, Ю. В. Пахомова // Организационно-экономические и управленческие аспекты функционирования и развития социально-экономических систем в условиях инновационной экономики : Сборник научных трудов по материалам Всероссийской научно-практической конференции, Воронеж, 23 мая 2019 года. – Воронеж: Воронежский государственный технический университет, 2019. – С. 34-42. |

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| **Module name** | **MAC-B59 - Management Accounting and Audit** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Nurpeis Edil Meirkhanuly (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -30; practice - 15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Innovation Management and Marketing |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  a system of knowledge formation in the field of management accounting basics, relevant competencies to work successfully in analytical, financial and economic, manufacturing companies in different business areas.  **LEARNING OUTCOMES:**  **Bachelor's students must know:**  Basic concepts, principles and tools of modern management accounting.  Modern approaches to the classification of costs and costing systems  cost of products and services.  Modern trends in the practice of management accounting theory.  Development features of management accounting systems, budgeting and  approaches to costing of products and services.  **Be able to**:  Analyze accounting information to make management decisions.  Use marginal approach and analysis to calculate financial results.  Analyze the level of marginal profit and identify factors influencing its value.  Apply tipping point analysis to make short-term management decisions in the areas of pricing, optimum sales volume, and cost reduction.  Use the budgeting system to plan and analyze the company's financial and economic activities.  Analyze budget execution, identifying the factors that influence factors affecting the deviation between planned and actual indicators, using the "standard-cost" system;  **COMPETENCES:**  - to demonstrate mastery of methods for analyzing specific situations related to the organization of management accounting in the company;  - to demonstrate mastery of methods for determining the place of management accounting in the organizational structure of the company;  - to demonstration mastery of the methods for identifying existing problems and formulating recommendations;  - to use deep theoretical and practical knowledge in the field of management accounting. |
| **Content** | Management accounting in the company management system. Technologies of collection and systematization of information. Preparation of operational decisions on the basis of management accounting information. Building a budgeting system. Monitoring the performance of the company's objectives, based on a comparison of actual results. Insurance of operational and financial risks, adjustment of goals and plans of the company. Carrying out auditing activities: standards, organization, procedures. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Арабян, К. К. Аудит. Теория, организация, методика и практика : учебник для студентов вузов, обучающихся по направлениям «Бухгалтерский учет, анализ и аудит», «Финансы и кредит» / К. К. Арабян. – Москва : ЮНИТИ-ДАНА, 2020. – 479 с. 2. Аудит : учебник для бакалавров / А. Е. Суглобов, Б. Т. Жарылгасова, В. Ю. Савин [и др.] ; под ред. д. э. н., проф. А. Е. Суглобова. – 4-е изд., перераб. и доп. – Москва : Издательско-торговая корпорация «Дашков и К°», 2020. – 373 с. 3. Аудит : учебник для вузов / Н. А. Казакова [и др.] ; под общей редакцией Н. А. Казаковой. – 3-е изд., перераб. и доп. – Москва : Издательство Юрайт, 2021. – 409 с. 4. Аудит в 2 ч. Часть 1 : учебник и практикум для вузов / под редакцией М. А. Штефан. – 3-е изд., перераб. и доп. – Москва : Издательство Юрайт, 2021. – 238 с. 5. Аудит в 2 ч. Часть 2 : учебник и практикум для вузов / под редакцией М. А. Штефан. – 3-е изд., перераб. и доп. – Москва : Издательство Юрайт, 2021. – 411 с. 6. Аудит: проблемы оценки качества : монография / Е.И. Ерохина [и др.].. – Москва : Научный консультант, 2020. – 248 c. 7. Белозерцева И.Б. Учет и аудит в организациях различных видов экономической деятельности : учебное пособие / Белозерцева И.Б.. – Москва : Ай Пи Ар Медиа, 2021. – 319 c. 8. Поленова, С. Н. Бухгалтерский учет и отчетность : учебник для бакалавров / С. Н. Поленова. – 2-е изд. – Москва : Дашков и К, 2021. – 402 с. 9. Воронина, Л. И. Международные стандарты аудита: теория и практика : учебник / Л.И. Воронина. – Москва : ИНФРА-М, 2020. – 456 с.. |

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| **Module name** | **MAC-B60 - Financial Management** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Tulegenova Saule Kuanyshevna, Senior Lecturer (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -30; practice - 15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Innovation Management and Marketing |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  formation of a set of knowledge, skills and abilities to manage the financial activities of an enterprise or division.  **LEARNING OUTCOMES:**  **Bachelor's students must know:**  – the essence and role of financial management in a market economy;  - the basic concepts of financial management;  - information base and basic indicators used in financial management;  - methods of managing sources of long-term financing;  - methods of managing costs, formation and distribution of income;  - the content of financial planning and forecasting.  **be able to**:  – analyze and evaluate the regulatory framework that forms the external environment of the organization;  - correctly apply the acquired knowledge to analyze and assess the financial condition of the organization.  **COMPETENCES:**  - to demonstrate skills in processing economic information using mathematical and statistical data processing apparatus;  - to demonstrate skills in financial planning and forecasting;  - to use deep theoretical and practical knowledge in the field of financial management. |
| **Content** | Concepts of financial management. Modern technologies of financial management. Business estimates, the logic of the pricing process for financial assets. Quantitative and qualitative methods of analysis of information in making management decisions. Principles of dividend policy and capital structure. Methods for making financial and investment decisions, assessment of financial and investment risks of an enterprise. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Гребенников, П. И. Корпоративные финансы : учебник и практикум для вузов / П. И. Гребенников, Л. С. Тарасевич. – 2-е изд., перераб. и доп. – Москва : Издательство Юрайт, 2020. – 252 с. 2. Дерюжков, И. С. Финансовый менеджмент в системе управления организацией / И. С. Дерюжков // Исследования и разработки в области машиностроения, энергетики и управления : Материалы XX Международной научно-технической конференции студентов, аспирантов и молодых ученых, Гомель, 23–24 апреля 2020 года. – Гомель: Гомельский государственный технический университет им. П.О. Сухого, 2020. – С. 332-334. 3. Екимова, К. В. Эффективные инструменты финансового менеджмента в условиях цифровой экономики / К. В. Екимова // Цифровая экономика: тенденции и перспективы развития : сборник тезисов докладов национальной научно-практической конференции: в двух томах, Москва, 22–23 октября 2020 года. – Москва: Российский экономический университет имени Г.В. Плеханова, 2020. – С. 194-196. 4. Екимова, К. В. Финансовый менеджмент : учебник для прикладного бакалавриата / К. В. Екимова, И. П. Савельева, К. В. Кардапольцев. – Москва : Издательство Юрайт, 2019. – 381 с. 5. Илышева, Н. Н. Учет и финансовый менеджмент: концептуальные основы : учеб. пособие / Н. Н. Илышева, С. И. Крылов, Е. Р. Синянская ; [науч. ред. Т. В. Зырянова] ; М-во образования и науки Рос. Федерации, Урал. федер. ун-т. – Екатеринбург : Изд-во Урал. ун-та, 2018. – 164 с. 6. Иншаков, П. В. Составляющие системы финансового менеджмента на предприятии / П. В. Иншаков, Р. Г. Ян, А. Р. Денисенко // Актуальные научные исследования в современном мире. – 2020. – № 6-3(62). – С. 124-127. 7. Иремадзе, Э. О. Информационные технологии в финансовом менеджменте / Э. О. Иремадзе, К. Э. Насырова, А. А. Яхина // Аллея науки. – 2020. – Т. 1. – № 6(45). – С. 962-965. 8. Каледин, С. В. Финансовый менеджмент. Расчет, моделирование и планирование финансовых показателей : учебное пособие для СПО / С. В. Каледин. – Санкт-Петербург : Издательство «Лань», 2020. – 520 с. 9. Карпович, О. Г. Финансовый менеджмент : учебник для бакалавров / О. Г. Карпович, А. Е. Сутлобов, Б. Т. Жарылгасова ; под ред. проф. О. Г. Карповича. – Москва : Издательско-торговая корпорация «Дашков и К°», 2018. – 396 с. 10. Кириченко, Т. Т. Финансовый менеджмент / Т. Т. Кириченко. — Москва : Дашков и К, 2018. — 484 с.. |

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| **Module name** | **MAC-B61 - Information Technology and Business Process Management** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Bazil Gulmira Duysenbekyzy (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Information and communication technology (in English)  Database Design/Database Management Systems  Computer networks in control systems  Modeling and identification of control objects  Information security in control systems. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:**  students gain skills in practical development and application of software modules of the production enterprise information management systems; mastering ways to solve problems of the production enterprises management at the production and administrative and economic levels with the help of modern automated control systems.  **LEARNING OUTCOMES:**  ability to author the processes of design, implementation and maintenance of information systems and technologies; making management decisions in the face of different opinions.  **Bachelor's students know:**  modern information technologies, applied software tools when solving problems of professional activity, different information systems and technologies features, their composition and capabilities for information processing; modern software tools that support these systems.  **Are able to:** use modern information technologies, applied software tools in solving the business processes management.  **COMPETENCES:**  **-** to demonstrate the ability to use modern information technologies, applied software tools in solving problems of professional activity;  - to use profound theoretical and practical knowledge in the field of application of software modules of information management systems of industrial enterprise. |
| **Content** | Basic concepts and classification of information technology, its application in the business processes management. The structure and hierarchy of information technology. Development of functional blocks, organization of the relationship between them. Automatic planning, budgeting. The system of bonuses, the management system and automated document management. Automatic data collection from the lower and middle levels of management, making management decisions, taking into account the planned indicators. |
| **Current control** | Course work, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Информационные ресурсы и технологии в экономике: Учебное пособие / Под ред. Романова А.Н.. - М.: Вузовский учебник, 2018. - 319 c.  2. Информационные системы и технологии / Под ред. Тельнова Ю.Ф.. - М.: Юнити, 2017. - 544 c.  3. Информационные технологии и вычислительные системы. Вычислительные системы. Компьютерная графика. Распознавание образов. Математическое моделирование / Под ред. С.В. Емельянова. - М.: Ленанд, 2015. - 100 c.  4. Балдин, К.В. Информационные технологии в менеджменте / К.В. Балдин. - М.: Academia, 2018. - 203 c.  5. Венделева, М.А. Информационные технологии в управлении.: Учебное пособие для бакалавров / М.А. Венделева, Ю.В. Вертакова. - Люберцы: Юрайт, 2016. - 462 c.  6. Гаврилов, Л.П. Информационные технологии в коммерции: Учебное пособие / Л.П. Гаврилов. - М.: Инфра-М, 2018. - 47 c.  7. Гагарина, Л.Г. Информационные технологии: Учебное пособие / Л.Г. Гагарина, Я.О. Теплова, Е.Л. Румянцева и др. - М.: Форум, 2018. - 144 c.  8. Гохберг, Г.С. Информационные технологии: Учебник / Г.С. Гохберг. - М.: Academia, 2018. - 474 c.  9. Дарков, А.В. Информационные технологии: теоретические основы: Учебное пособие / А.В. Дарков, Н.Н. Шапошников. - СПб.: Лань, 2016. - 448 c. |

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| **Module name** | **MAС-B62- Mathematical modeling and design of business process management systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Bazil Gulmira Düysenbekyzy (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mathematical basis of automation / Mathematical methods in automation issues  Modeling and identification of control objects. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** studying theoretical and practical foundations of process management, modeling and analysis of business processes, as well as acquiring practical skills in modeling business processes**.**  **LEARNING OUTCOMES:** ability to design and implement components of the IT infrastructure of the enterprise, ensuring the achievement of strategic goals and support of business processes  **Bachelor's students know:**  basic laws of natural science disciplines in professional activity, apply methods of mathematical analysis and modeling, theoretical and experimental research.  **Are able to:** Install software and hardware for information and automated systems  **COMPETENCES:**  **-** to demonstrate the ability to provide a mathematical justification of the problem statement, to use mathematical modeling for the components of business processes description, to conduct mathematical analysis;  - to use deep theoretical and practical knowledge in the field of mathematical support for the business processes development. |
| **Content** | Methods of business processes mathematical modeling. Development of mathematical models to optimize the enterprise operation, predicting and minimizing the risks at each stage of the enterprise. Linear and nonlinear optimization models based on management criteria, methods and ways of their solution. Stages of business processes modeling, modeling in conditions of uncertainty. Process approaches to the design of business process management systems. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Моделирование экономических процессов: Учебник / Под ред. М.В. Грачевой, Ю.Н. Черемных. - М.: Юнити, 2013. - 543 c.  2. Труды ИСА РАН: Математическое моделирование. Математические модели в экономике. Численные методы. Оценка эффективности инвестиционных проектов. / Под ред. С.В. Емельянова. - М.: Красанд, 2014. - 112 c.  3. Труды ИСА РАН: Математические модели социально-экономических процессов. Моделирование характеристик деятельности отраслевых и региональных подсистем. Динамические системы. Математические проблемы динамики неоднородных систем.: Информационные технологии / Под ред. С.В. Емельянова. - М.: Ленанд, 2015. - 112 c.  4. Акопов, А.С. Имитационное моделирование: Учебник и практикум для академического бакалавриата / А.С. Акопов. - Люберцы: Юрайт, 2016. - 389 c.  5. Алексеев, Г.В. Численное экономико-математическое моделирование и оптимизация / Г.В. Алексеев. - СПб.: Гиорд, 2014. - 272 c.  6. Алексеев, Д.В. Введение в компьютерное моделирование физических задач: Использование Microsoft Visual Basic / Д.В. Алексеев. - М.: Ленанд, 2019. - 272 c.  7. Алпатов, Ю.Н. Математическое моделирование производственных процессов: Учебное пособие / Ю.Н. Алпатов. - СПб.: Лань, 2018. - 136 c.  8. Алпатов, Ю.Н. Моделирование процессов и систем управления: Учебное пособие / Ю.Н. Алпатов. - СПб.: Лань, 2018. - 140 c.  9. Афонин, В.В. Моделирование систем: Учебно-практическое пособие / В.В. Афонин. - М.: Бином. ЛЗ, ИНТУИТ, 2012. - 231 c.  10. Бабешко, Л.О. Математическое моделирование финансовой деятельности / Л.О. Бабешко. - М.: КноРус, 2014. - 544 c. |

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| **Module name** | **MAC-B63 - Automation of internal production planning** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Associate Professor, PhD Bazil Gulmira Düysenbekyzy (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Modeling and identification of control objects, Management Accounting and Audit, Financial Management, Innovation Management and Marketing |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** students acquire the skills of practical development and application of knowledge representation models in the problems of management of the production enterprise with information support of the production stage; mastering solving problems methodology for management of production enterprises at the production and administrative and economic levels.  **LEARNING OUTCOMES:** the formation of students' comprehensive understanding of organization and management as modern fundamental sciences that study the behavior of economic entities departments, the formation of organizational and managerial thinking, the development of systematization skills and analysis of information.  **Bachelor's students know:**  fundamental principles, forms and methods of production and management organization; the essence, methods of planning and management, indicators of innovation processes effectiveness.  **Are able to:** develop and implement effective enterprise organization mechanisms; assess the effectiveness of management actions for the development of the production enterprise; formulate goals and objectives for executives in accordance with the requirements of the business plan and varied situations of internal and external environment; form options for management decisions, evaluate them and choose the best; apply in practice theoretical principles, methods and models of technological management.  **COMPETENCES:**  - to use deep theoretical and practical knowledge in the field of planning, types, forms and structure of plans, technical and economic indicators and algorithms of their calculations;  - to demonstrate modern technology of planning work at the enterprise, allowing to develop and justify the most optimal variants of plans of different levels of economic entities development in modern conditions. |
| **Content** | Intraproduction planning - the essence, content, principles, methods, indicators. Planning and analysis of the production program implementation. Planning of labor and wages. Planning the production cost or services. Financial planning, analysis of the implementation of the plan for production costs, profits and profitability. Operational and business planning of production. Automated planning systems based on ERP, APS and MRP standards. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Алексеева М.M. Планирование деятельности фирмы/ М.М. Алексеева.- М.: Финансы статистика, 2010. - 248 с.  2. Лысенко Д.В. Комплексный экономический анализ хозяйственной деятельности/ Д.В. Лысенко.- М.:Инфра - М, 2011.-320 с.  3. БасовскийЛ.Е. Прогнозирование и планирование в условиях рынка/ Л.Е. Басовский. - М.: Инфра-М, 2010.- 378 с.  4. Лапыгин Ю.Н. Сборник бизнес- планов реальных организаций/ Ю.В. Андриянов, Е.В. Бобкова, Ю.Н. Лапыгин.- М.: Омега-Л, 2011.- 304с.  5. Рыжакина Т.Г. Планирование на предприятии Т.Г. Рыжакина; Томский политехнический университет.- Томск: Изд-во Томского политехнического университета, 2015.- 193 с.  6. Ляско В. И. Стратегическое планирование развития предприятия/ В.И. Ляско.-М.: Экзамен, 2010.- 310 с.  7. Царев В.В. Внутрифирменное планирование / В.В. Царев.- СПб.: Питер, 2010.- 496 с.  8. Алексеенко Н.А. Экономика промышленного предприятия/ Н.А. Алексеенко, И.Н. Гурова. - Минск: Изд-во Гревцова, 2011. - 246 с.  9. Бухалков М.И. Внутрифирменное планирование/ М.И. Бухалков. - М.: Инфра - М, 2009. - 392 с.  10. Черняк В.З. Бизнес- планирование/ В.З. Черняк,А.В. Черняк, И.В. Довдиенко. - М.: Изд-во РДЛ, 2005. - 271 с.  11. Горемыкин В.А. Планирование на предприятии/ В. А. Горемыкин.- М.: Высшее образование, 2012. - 695 с. |

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| **Module name** | **MAC-B64 - Automation and basics of robot control** |
| **Semester(s), in which the module is taught** | 5 |
| **Person, responsible for the module** | Senior Lecturer, Candidate of Technical Sciences Kussainov Bukhar Kazhikenovich (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mathematical basis of automation / Mathematical methods in automation issues  Elements and devices of automation / Technical means of automation |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** to master theoretical and practical knowledge as well as skills and abilities in analytical description, research and modeling of mechanical system and automatic control system of electric drive of a manipulating robot link.  **LEARNING OUTCOMES:** Knowledge and ability to analytically describe, research and simulate the mechanical system and the executive automatic control system of a multi-link manipulating robot designed to perform production operations.  **Bachelor's students know:**  - functional description of industrial robots, their classification and purpose, as well as the classification of their automatic control systems;  - kinematic description, determination of positions, velocities and accelerations of the links of manipulating robots, methods of solving direct and inverse kinematics problems;  - methods of dynamic research, methods of composing the equations of motion of the links and determining the forces and moments acting on the links of a manipulating robot;  - methods of kinematics and dynamics modeling of the mechanical system of a manipulating robot with the help of software tools;  - theoretical methods of synthesis, practical ways of construction and research of the executive system of automatic control of one mobility degree of a manipulating robot;  - multi-linked system construction of automatic control of a robot working tool (grip) and investigation of mutual influence of degrees of mobility of a multi-linked manipulating robot;  - ways of modeling, synthesis and research of executive system of robot link automatic control and mutual influence of robot links with the help of software tools (MatLab/Simulink);  **Are able to:**  - perform analytical kinematics of mechanical system description of multi-link manipulating robot and plan its movements;  - apply methods of dynamics description, compose equations of links motion, determine the forces and moments of links of a manipulating robot;  - carry out the executive system synthesis of automatic control of one link of a manipulating robot and investigate mutual influence of its links;  - apply modern software tools for modeling mechanical system, synthesis and research of the executive system of automatic control of a manipulating robot.  **COMPETENCES:**  - to demonstrate knowledge of kinematic and dynamic description of mechanical systems (manipulators) analytical methods of manipulating robots and ways to study their mechanics by modeling with the help of modern software tools;  - to demonstrate knowledge of theoretical synthesis methods, construction and research of the executive system of automatic control of manipulating robot practical methods in the analytical form and with the help of software (MatLab/Simulink). |
| **Content** | Automatic and automated systems, the place of industrial robots in the production process. Manipulation robot as a mechanical system. Linear coordinate transformations, homogeneous coordinates and linear transformations, position of manipulator's grip (working organ) in working space. Denavit-Hartenberg representation. Direct and inverse positional problems, solution methods. Synthesis of program trajectories by degrees of mobility of a manipulating robot. Kinematic control. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Ступина Е.Е., Ступин А.А., Чупин Д.Ю., Каменев Р.В. Основы робототехники: учеб. пособие. – Новосибирск: Агентство «Сибпринт», 2019. – 160 с.  2. Смирнов А.Б., Тимофеев А.Н. Промышленные и сервисные роботы: учеб. пособие. – СПб.: С-Пб политехн. унив. Петра Великого, 2019. – 139 с.  3. Хомченко В.Г. Робототехнические системы: учеб. пособие. – Омск: ОмГТУ, 2016. – 195 с.  4. Шахворостов С.А. Роботы в системах автоматизации: учеб. пособие. – Красноярск: Научно-иннов. центр, 2016. – 110 с.  5. Чигарев А. В., Циммерманн К., Чигарев В. А. Введение в мехатронику : учеб. пособие для втузов / Чигарев А. В., Циммерманн К., Чигарев В. А. ; Белорусский нац. техн. ун-т. - Минск : Изд-во БНТУ, 2013. - 387 с.  6. Проектирование роботов и робототехнических систем: метод. реком. К лабораторным работам /А.В. Капитонов. – Могилев: ГУ ВПО «Белорусско-Российский университет», 2018. – 46 с.  7. Механика авиационных робототехнических систем : учебник для вузов / Нестеров В. А., Куприков М. Ю., Обносов Б. В. [и др.] ; общ. ред. Нестеров В. А. - 3-е изд., перераб. и доп. - М. : ИТК"Дашков и К", 2014. - 462 с.  8. Моделирование роботов: Метод. указания по выполнению лабораторных работ для студентов направления 15.03.06 Мехатроника и робототехника / Юго-Зап. гос. ун-т; сост.: Б.В.Лушников. – Курск, 2017. – 22 с.  9. <http://roboticslib.ru/books/>  10. <https://www.studmed.ru/science/avtomatizaciya/robots/> |

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| **Module name** | **MAC-B65 - Mechanics of industrial robotic systems** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Prof. Serikbay Baytikovich Kosbolov, doctor of technical sciences (Russian, Kazakh) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** |  |
| **Required and recommended pre-requisites for joining the module** | Mathematics 1,2, Physics, Advanced Physics/Special issues of physics, Elements and devices of automation / Technical means of automation, Electronics, Automation and basics of robot control |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** study of general research methods and design of machines mechanisms and robotics; preparation for the study of other general engineering and special disciplines; description of the general connection and motives of individual concepts, replacement of private research with more general systematic methods, development of students' logical thinking, skills of independent thinking, necessary in further work when solving problems of science and technology  **LEARNING OUTCOMES:**  **Bachelor's students know:**  - basic concepts and laws included in this program;  - the relationship, interdependence, and mutual influence of these concepts, not only among themselves, but also with other disciplines.  **Are able to:**  - argue accurately and thoroughly, without overburdening it with unnecessary details;  - apply the studied material in a variety of areas.  **COMPETENCES:**  - to demonstrate skills in solving problems related to the movement of mechanism links;  - to use use deep theoretical and practical knowledge in the theory of machine mechanisms and robotics. |
| **Content** | The concept, structure and characteristics of robotic systems of automated industries. Industrial robot as an element of robotic system. The main units and devices, design of Gearbox Features that implement rotational motion of degrees of mobility. Design features of gearboxes implementing linear movement of degrees of mobility. Industrial robots - gantry, mobile, storage, measuring, parallel. Gripping devices of industrial robots. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Сибикин, М.Ю. Технологическое оборудование заготовительных и складских производств машиностроительных предприятий: учебное пособие / М.Ю. Сибикин. - Москва: Директ-Медиа, 2014. - 359 с.: табл., рис. - Библиогр. в кн. - ISBN 978-5-4458-5748-8; 2. Камлюк, В.С. Мехатронные модули и системы в технологическом оборудовании для микроэлектроники: учебное пособие / В.С. Камлюк, Д.В. Камлюк. - Минск: РИПО, 2016. - 383 с.: схем, табл. - Библиогр. в кн. - ISBN 978-985-503-627-3; 3. Устройства программного управления в автоматизированном производстве: пособие / А.А. Гончаров, Н.В. Сурба, Е.Н. Велюжинец, Ю.Н. Петренко. - Минск: РИПО, 2017. - 272 с.: схем, табл., ил. - Библиогр. в кн. - ISBN 978-985-503-660-0; 4. Козырев Ю.Г. Промышленные роботы: основные типы и технические характеристики. учебное пособие. - М.: КНОРУС, 2017. -560 с. 5. Козырев Ю.Г.Гибкие производственные системы. Справочник. справочное издание. -М.: КНОРУС, 2017. -364 с. 6. Козырев Ю.Г. Применение промышленных роботов. -М.: КноРус, 2013. -488 с. 7. Козырев Ю.Г. Захватные устройства и инструменты промышленных роботов. -М.: КноРус, 2013. -318 с. 8. Бутенко В.И., Дуров Д.С., Шаповалов Р.Г. Численное моделирование работы рычажного механизма при конструировании промышленных роботов с рекуперацией энергии. - Известия юфу. Технические науки. -№1(150).- 2014.-С.174-180. |

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| **Module name** | **MAC-B66 - Information and measuring means of mass production** |
| **Semester(s), in which the module is taught** | 6 |
| **Person, responsible for the module** | Senior Lecturer, Candidate of Technical Sciences Kussainov Bukhar Kazhikenovich (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation/Technical means of automation  Automation and basics of robot control |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To master theoretical and practical knowledge and skills in the construction and study of information and measurement tools and systems that are an integral part of control systems of automated industries.  **LEARNING OUTCOMES:** Study of information and measurement devices in the form of primary information transducers (sensors, sensors) used to input signals into the computer (microprocessor, microcontroller) system and build on its basis information and measurement system, which is an integral part of control systems of automated industries.  **Bachelor's students know:**  - the structure, principles of construction and functioning, calculation of the most important parameters, methods of organization and application of sensors of different types;  - methods and ways to build microprocessor and microcontroller systems with various sensors;  - practical methods of using sensors in production control and management systems; methods of designing information and measuring instruments and systems.  **are able to:**  - apply sensors of different types in production control and management systems;  - build microprocessor and microcontroller systems with different sensors;  - design information and measurement tools and systems.  **COMPETENCES:**  - to demonstrate knowledge of devices and functioning principles of primary transducers of information (sensors, sensors) used in control and monitoring systems of production for signal input to computer (microprocessor, microcontroller) system;  - to use in-depth and theoretical knowledge in the field of information and measurement system construction, which is an integral part of control systems of automated production. |
| **Content** | Information and measurement tools. The device, the principles of construction. Calculation of the most important parameters, methods of organization and use of sensors of various types. Methods of building microprocessor, microcontroller control and monitoring systems of automated production with the use of sensors of various types. Algorithms of processing of measured information. Mathematical models of information and measurement systems, software simulation complexes. |
| **Current control** | Course work, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Сырямкин В.И. Информационные устройства и системы в робототехнике и мехатронике: учебное пособие. (Серия: Интеллектуальные технические системы). – Томск: Изд. Том. ун-та, 2016. – 524 с.  2. Воротников С.А. Информационные устройства робототехнических систем: учеб. пособие. - М.: Изд-во МГТУ им. Н.Э.Баумана, 2005. – 384 с.  3.  4. Ачильдиев В. М., Грузевич Ю. К., Солдатенков В. А. Информационные измерительные и оптико-электронные системы на основе микро- и наномеханических датчиков угловой скорости и линейного ускорения. - М. : Изд-во МГТУ им. Н. Э. Баумана, 2016. - 260 с.  5. Крапивин Д.М. Информационные системы в мехатронике и робототехнике: учебно-метод. пособие по вып. курс. работы. – Новочеркасск: Южноросс. гос. политехн. унив. (НПИ) имени М.И. Платова, 2017. - 35 с.  6. Власов С.М., Бойков В.И., Быстров С.В., Григорьев В.В. Бесконтактные средства локальной ориентации роботов: учеб. пособие. - СПб, Университет ИТМО, 2017. – 169 с.  7. Ключев А.О., Кустарев П.В., Платунов А.Е. Аппаратные средства информационно-управляющих систем: учеб. пособие. - СПб, Университет ИТМО, 2015. – 65 с.  8. <http://techliter.ru/load/uchebniki_posobya_lekcii/robototekhnika_i_robotostroenie_promyshlennye_roboty/> |

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| **Module name** | **MAC-B67 - Software control of flexible manufacturing systems** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Senior Lecturer, Candidate of Technical Sciences Kussainov Bukhar Kazhikenovich (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Industrial networks and interfaces  Programming of digital technology and microcontrollers / PLC software  Mechanics of industrial robotic systems  Information and measuring means of mass production |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To master theoretical and practical knowledge, as well as skills and abilities in the preparation of automated technological processes and the programming of industrial robots and numerically controlled equipment.  **LEARNING OUTCOMES:** Knowledge of computer numerical control (CNC) systems for process equipment (machine tools), industrial robots (IR) and robotic technological complexes (RTC) and programming of technological processes and automated equipment with CNC.  **Bachelor's students know:**  - computer numerical control (CNC) systems for technological equipment (machines), industrial robots (IR) and robotic technological complexes (RTC);  - the stages content of the technological processes preparation and control programs for numerically controlled automated equipment, industrial robots and robotic technological complexes;  - methods of computer numerical control of technological processes, automated equipment, industrial robots and robotic technological complexes;  - systems of automated preparation of control programs for numerically controlled equipment, industrial robots and robotic technological complexes.  **Are able to:**  - prepare technological processes with automated equipment and to program machine tools, industrial robots and numerically controlled robotic technological complexes.  **COMPETENCES:**  **To demonstrate** knowledge of the stages of technological processes preparation and programming of numerically controlled automated equipment, industrial robots and robotic technological complexes;  **To demonstrate** ability in the area of programming numerical program control of technological processes;  **To use** deep theoretical and practical knowledge in the field of systems of automated preparation of control programs for numerically controlled equipment. |
| **Content** | Flexible automated production or flexible manufacturing systems, as the need to respond to product updates and changes in demand. Software control and control programs of robotic complexes and other technological equipment. Automated changeover when changing product ranges. Programming of technological processes and control programs for numerically controlled equipment. |
| **Current control** | Course work, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Пронин А.И. Технологические основы гибких автоматизированных производств: учеб. пособие. – Комсомольск-на-Амуре: ФГБОУ ВПО «КнАГТУ», 2015. – 135 с.  2. Любимов В.И., Белявин К.Е. Организационно-технические основы гибкого автоматизированного производства: метод. пособие. – Минск: БНТУ, 2012. – 200 с.  3. Горюнова В.А. Устройства программного управления в автоматизированном производстве: учеб.-метод. пособие. – Минск: РИПО, 2018. – 68 с.  4. Рязанов А.И., Карпов А.В. Базовые методы подготовки управляющих программ для токарных станков с ЧПУ: учеб. пособие.- Самара: Самарский нац. иссл. унив. имени акад. С.П.Королева, 2021. – 88 с.  5. Псигин Ю.В. Управление производственными системами: учеб.-метод. пособие. – Ульяновск: Ульяновс. гос. техн. унив. (УлГТУ), 2019. -180 с.  6. Чепчуров М.С., Жуков Е.М. Оборудование с ЧПУ машиностроительного производства и программная обработка: учеб. пособие. – Белгород: Белгородский гос. технол. унив. им. В.Г. Шухова. ЭБС АСВ, 2015. – 190 с.  7. Серебреницкий П.П., Схиртладзе А.Г. Программирование для автоматизированного оборудования: учебник. – М.: Высш. шк., 2003. – 592 с.  8. Ермолаев В.В. Программирование для автоматизированного оборудования: учебник. – М.: Изд. центр «Академия», 2014. - 251 с.  9.  <https://studref.com/523670/tehnika/avtomatizatsiya_proizvodstvennyh_protsessov_v_mashinostroenii> |

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| **Module name** | **MAC-B68 - Control systems for executive mechanisms of automated production** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Professor Zhauyt Elgazy (Russian language) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  Elective, specialization |
| **Teaching methods** | lectures, laboratory works, course work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -30; practice - 15; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Elements and devices of automation / Technical means of automation, Electronics, Systems of industrial pneumoautomatics and electropneumoautomatics, Automation and basics of robot control, Mechanics of industrial robotic systems. |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** Mastering of the mechanisms theory, the principle of operation of robot actuators and controls. Studying the basics of the mechanisms and machines theory. Practical ways of their application; preparation for mastering special and engineering disciplines.  **LEARNING OUTCOMES:**  **Bachelor's students know:**   * Basic concepts and laws of the mechanisms theory. * Classification of actuating mechanisms of robotic systems. * Classification and structure of kinematic chains. * The operation principles of industrial robot manipulators.   **- are able to:**   * Read and build kinematic diagrams; * Perform dynamic analysis of the actuator mechanism; * Determine the number of degrees of freedom: * Design the actuating mechanism of robotic systems.   **COMPETENCES:**  - to demonstrate skills in performing dynamic analysis of an actuator mechanism;  - to demonstrate skills of designing mechanism of robotic systems;  - to use deep theoretical and practical knowledge in the field of control systems of actuators of automated production. |
| **Content** | Application of manipulative robots as actuating mechanisms in automated production. Manipulation robots as multi-link devices, interconnected and mutually influencing each other. Drives and tracking control systems of manipulative robot links. Actuating devices of drives: electric motors of direct and alternating current. Design of tracking control systems for degrees of mobility drives of a manipulating robot. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Теория механизмов и машин. Проектирование элементов и устройств технологических систем электронной техники: учебник для вузов / Е. Н. Ивашов, П. А. Лучников, А. С. Сигов, С. В. Степанчиков ; под редакцией А. С. Сигова. — 2-е изд., перераб. и доп. — Москва : Издательство Юрайт, 2022. — 369 с. — (Высшее образование). — ISBN 978-5-534-03196-6. — URL: <https://urait.ru/bcode/490216> 2. Михайлов, Ю. Б. Конструирование деталей механизмов и машин: учебное пособие для вузов / Ю. Б. Михайлов. — Москва: Издательство Юрайт, 2022. — 414 с. — (Высшее образование). — ISBN 978-5-534-03810-1. — URL: <https://urait.ru/bcode/488885> 3. Джумагулова Н. Б. Динамический анализ и синтез механизмов: Методические указания к практическим занятиям по ТММ. Алматы, 2005. 4. Қансейтов Қ. И., Қосболов С. Б. Жазық рычагты механизмдердің құрылымдық, кинематикалық және күштік талдаулары. Машиналар мен механизмдер теориясы пәнінен курстық жобаны орындауға арналған әдістемелік нұсқау. Алматы, 2002. |

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| **Module name** | **MAC-B69 - Designing of control systems for robotic complexes** |
| **Semester(s), in which the module is taught** | 7 |
| **Person, responsible for the module** | Senior Lecturer, Candidate of Technical Sciences Kussainov Bukhar Kazhikenovich (Kazakh, Russian) |
| **Language** | Kazakh/Russian |
| **Relation to curriculum** | **Compulsory / elective/ specialization**  **Elective, specialization** |
| **Teaching methods** | lectures, laboratory works, calculation graphic work, self- study work of a bachelor’s student under a teacher supervision (SSTS) |
| **Working hours (including class hours, self-study hours)** | **Working hours:** 150 hours  **Class hours:**  lectures -15; laboratory classes - 30; SSW – 99 (SSTS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended pre-requisites for joining the module** | Mechanics of industrial robotic systems  Industrial networks and interfaces  Automation and basics of robot control  Information and measuring means of mass production  Microprocessor complexes in control systems / Basics of distributed control systems |
| **Module objectives/intended learning outcomes** | **MODULE AIM:** To master theoretical and practical knowledge as well as skills and abilities in the design, modeling and application of robotic technological complexes for the automation of production processes.  **LEARNING OUTCOMES:** Mastering the skills of automating technological production processes using industrial robots and the design of robotic technological complexes, off-line programming of industrial robots and simulation of robotic technological complex in an industrial software environment.  **Bachelor's students know:**  - the content of the technical and economic analysis stages and design of robotic technological complex in order to automate technological processes using industrial robots;  - characteristics of serial industrial robots, composition and functions of the main and auxiliary equipment, used structures and layouts of robotic technological complexes.  - methods of determining the manipulation trajectories of the manufactured product, the cyclogram development of robotic movements and the algorithm of the robotic technological complex of the product manufacturing.  - basic functions of industrial software environment for off-line programming of industrial robots, design and simulation of robotic technological complexes.  **- are able to:**  - analyze the technological process and prepare source data for the design of robotic technological complex.  - select the necessary composition of the main technological equipment and determine the sequence of its processing of the product.  - form the structure and layout of robotic technological complex, select the number and characteristics of robots, choose the auxiliary equipment of the technological process.  - develop manipulation trajectories, cyclogram of robot movements and algorithm of robotic technological complex operation.  - carry out off-line programming of industrial robots, design and simulation of the robotic technological complex in an industrial software environment.  **COMPETENCES:**  - **To demonstrate** proficiency in technical and economic analysis and preparation of input data for production automation using industrial robots and robotic technological complexes.  - **to demonstrate** skills in selecting the structure and layout of robotic technological complexes, the number and characteristics of robots, main and auxiliary equipment of technological processes.  - **to demonstrate** skills in the development of manipulation trajectories of the manufactured product, cyclograms of robot movements and algorithm of robotic technological complexes of manufacturing automation.  - **to demonstrate** skills of off-line programming of industrial robots, design and simulation of robotic technological complex in the industrial software environment. |
| **Content** | Composition, structure and functions of the robotic complex. Selection of technological equipment, selection of a model of commercially available industrial robot for the robotization of a technological operation. Mathematical models and algorithms for the construction of the layout diagram of the robotic complex. Development of the industrial robot control cycle diagram as a part of the robotic complex. Interface device for the industrial robot and the basic technological equipment. Simulation of the functioning modes of robotic complexes. |
| **Current control** | Calculation graphic work 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, laboratory equipment |
| **References** | 1. Лукинов А.П. Проектирование мехатронных и робототехнических устройств: учеб. пособие. – СПб.: Изд-во «Лань», 2012. – 608 с.  2. Сергеев А.С., Макаров А.М., Поступаева С.Г., Тихонова Ж.С. Промышленные роботы и роботизированные технологические комплексы: учеб. пособие. – Волгоград: Волгогр. ГТУ, 2018. – 128 с.  3. Моисеев Ю.И. Применение промышленных роботов для загрузки металлообрабатывающего оборудования: учеб. пособие. – Курган: Изд-во Курганского гос. уиверситета, 2013. – 170 с.  4. Макаров А.М., Иванюк А.К., Поступаева С.Г. Исследование роботизированной ячейки на базе промышленного робота KUKA: учеб. пособие. – Волгоград, Волгогр. гос. техн. унив., 2021. – 128 с.  5. Ивацевич Ю.Б., Лаврентьев Е.Б. Роботизированные технологические комплексы сборочного производства: учеб. пособие. – Ростов-на-Дону: Донской гос. техн. унив., 2015. -124 с.  6. Булгаков А.Г., Воробьев В.А. Промышленные роботы. Кинематика, динамика, контроль и управление. – М.: Солон-Пресс, 2017. – 485 с.  7. Богоявленский А.В., Храмов И.М., Транспортные и загрузочные устройства автоматизированного производства: учеб. пособие. – Екатеринбург: Уральский университет, 2020. – 172 с.  8. <https://www.studmed.ru/science/avtomatizaciya/robots/promyshlennaya-robototehnika> |