



Module Handbook

for the degree program

**RADIO ENGINEERING, ELECTRONICS AND TELECOMMUNICATIONS**

(Direction: Master's studies scientific and pedagogical)



Almaty, 2020-2022

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Curriculum of postgraduate studies

7M06201 - Radio Engineering, Electronics and Telecommunications

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| **Module name** | **MRET-M1 "History and Philosophy of Science"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Professor Mukhamedzhan Kuanysh Shakyrtuly (Kaz.)  Associate professor Sharakpaeva Gulnar Dmitrievna (Rus.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 90 hours  **Class hours:**  Lectures -15 hours; practical classes (seminars) - 15 hours; SSW-54 (MSWS - 5) hours.  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Philosophy; Module of socio-political knowledge (sociology, political science); Module of socio-political knowledge (culturology, psychology) |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** scientific thinking style development based on the study of history and philosophy of science.  **LEARNING OUTCOMES:**  **Graduate students know**:   * The nature, structure, principles of organization and functioning of science; * relationship between scientific and philosophical thought; * fundamental basis and conceptual apparatus of the history and philosophy of science; * basic principles of research activities.   **Are able to:**   * integrate knowledge, skills, social and methodological capabilities in work or learning situations; * classify methods of scientific and philosophical knowledge of the world; * describe the main content of ontology and metaphysics in the context of history and philosophy of science.   **COMPETENCES:**   * -demonstrate skills to develop cognitive and practical abilities. |
| **Content** | The module content consists of the main topics of philosophy of science, problems and results of philosophy of science, their significance for science and philosophy as a general methodology of cognitive activity of the undergraduate student. Regularities in the development of scientific knowledge as a subject of history and philosophy of science. Aspects of the history and philosophy of science study: philosophy of science, science studies, sociology of science, psychology of science, ethics of science. Science as a knowledge system and a social institution. Science as a form of social consciousness and productive force of society. Disputes about the place and role of science in culture: scientism and antiscientism. Internalism and externalism, two competing concepts in the history of science: Alexander Coiré and John Desmond Bernal as examples of the approaches implementation. Cumulativist and anti-cumulativist models of the scientific knowledge dynamics. |
| **Current control** | Semester works 1,2, Midterm control 1,2, oral presentation, essay. |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software, compliance with ethical standards in the classroom and during the exam |
| **References** | 1. История и философия науки: учебное пособие. Н.В. Бряник, О.Н. Томюк.- М.: Юрайт, Екатеринбург: Изд-во Уральского университета, 2020. 2. Розин В.М. История и философия науки. Учебное пособие для бакалавриата и магистратуры. – М.: Юрайт,2019. 3. Степин В.С. История и философия науки. – М.: Академический Проект, 2011. – 423 с. 4. Хасанов М.Ш., Петрова В.Ф. История и философия науки. – Алматы: Қазақ университеті, 2013. – 150 с. 5. Бучило Н.Ф., Исаев И.А. История и философия науки. – М.: «Проспект», 2012. 6. Мухамеджан К.Ш., Шаракпаева Г.Д., Шицко В.Л. История и философия науки. Конспект лекций для всех специальностей. – Алматы, 2010. 7. Шаракпаева Г.Д., Шицко В.Л. История и философия науки. Методические указания к семинарским занятиям для магистрантов всех специальностей. – Алматы, 2009. 8. Митрошенков О.А. История и философия науки. М.: Юрайт,2020. 9. Бакеева Е.В. Современная философия. Введение в онтологию: учебное пособие. М.: Юрайт,2020. 10. Кохановский В.П., Лешкевич Т.Г., Матяш Т.П., Фатхи Т.Б. «Философия науки» в вопросах и ответах. – Ростов – на – Дону, 2008. 11. Е.В. Ушаков. «Введение в философию и методологию науки». – М., 2008. 12. Кохановский В.П., Лешкевич Т.Г., Матяш Т.П., Фатхи Т.Б. «Основы философии науки». – Ростов – на – Дону, 2007. 13. Кохановский В.П., Лешкевич Т.Г., Матяш Т.П., Фатхи Т.Б. «Философия науки» в вопросах и ответах. – Ростов – на – Дону, 2007. 14. Философия науки. Общий курс: учебное пособие. Под ред. С.А. Лебедева. 5-е изд. перераб. и дополненное. – М., 2007. |

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| **Module name** | **MRET-M2 "Foreign Language (Professional) "** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Zussupova Akbota Utepbergenovna (kaz, rus.engl) |
| **Language** | English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | practical seminars, semester works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Practice - 45 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Foreign language 1, 2 |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** development of basic communication skills necessary for successful business, including searching, processing information in English. The course is mainly aimed at teaching practical English.  **LEARNING OUTCOMES:**  **Graduate students know**:   * ethics of business communication; * appropriate and grammatically correct use of scientific and technical terminology in practical communication   **Are able to:**   * translate technical and scientific texts; * maintain a conversation in the business English sphere   **COMPETENCES:**   * Demonstrate the ability to evaluate, analyze, and summarize English texts related to professional areas of communication; * Demonstrate compliance with etiquette in oral and written communication. |
| **Content** | The course content corresponds to the specifics of the professional education of undergraduates.  Educational components of the program are implemented in parallel and in conjunction with the main specialization, so that the study of the language contributes to obtaining knowledge from a wide range of practical activities. |
| **Current control** | Semester assignments 1,2,3, Midterm control 1.2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, course books, audio-video materials |
| **References** | 1. Loan Magretta. What Management is: How it Works and Why. // Free Press; Reissue edition. US, 2018, 256 p. 2. David Cotton. David Falvey. Simon Kent. Market Leader. Business English. Intermediate. – Pearson Education, 2008. 3. У.Б. Серикбаева. Английский язык. Учебное пособие для магистрантов всех специальностей. 6М0719, 6МО717, 6МО718, 6МО702 – Алматы. АУЭС.2011. – 88 с. 4. А.Л.Луговая.Английский язык для студентов энергетических специальностей: учебное пособие. М., Высшая школа, 2017. -150 с. 5. Electric Circuit Problems for Energy Industry (Электронный ресурс). <http://www.physicsclassroom.com/Class/circuits/u914c.cfm> 6. Коробейникова Л. Я. Английский язык. Методические указания по развитию умений написания эссе (для магистрантов всех специальностей), 2010. 7. Коробейникова Л. Я. Английский язык. Методические указания по развитию умений выступления с презентацией (для магистрантов всех специальностей), 2011. 8. Радовель В.А. Учебное пособие Английский язык для технических вузов. Москва. 2010 9. Murphy, Raymond. Essential Grammar in Use. A self study reference and practice book for elemePpress.2007. 10. Бухаров Г.П. Техническое чтение для энергетиков. Учебное пособие. Ульяновск. 2004.-112 с. |

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| **Module name** | **MRET-M3 "Higher School Pedagogy"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Senior lecturer Toleshova Ulmeken Bolatovna (Rus.)  Senior lecturer Toleshova Ulmeken Bolatovna (Kaz.),(Kaz.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Lectures, practical seminars, semester works, calculation and graphic works, Master’s self-study work under teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Practice - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Module of socio-political knowledge (sociology, political science); Module of socio-political knowledge (culturology, psychology) |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** formation of pedagogical competence, the ability of pedagogical activity in universities based on knowledge of higher school didactics, the theory of education and education management, analysis and self-evaluation of teaching activities.  **LEARNING OUTCOMES:**  **Graduate students know**:   * the basics of pedagogical activity in higher education; * megatrends in the development of education and the Bologna process; * different strategies and methods of training and education in higher education;   **Are able to:**   * effectively apply modern didactic principles and technologies of analysis, planning and organization of training and education in professional and pedagogical activity; * develop strategies for professional growth, self-reflection and acquisition of teaching experience at the higher education level; * apply traditional and innovative methods and forms of organization of training and education, new educational technologies in higher education.   **COMPETENCES:**   * Demonstrate the ability to systematically present and understand the essence of pedagogical activity of a university teacher, current problems of education system in general and pedagogical science in particular; * demonstrate the application of traditional and innovative methods and forms of training and education, new educational technologies in higher education. * structure the content of higher professional education; assess students' competences. |
| **Content** | The course is aimed at familiarizing with megatrends of educational development and the Bologna process, mastering lecturing, curatorial skills using various strategies and methods of teaching and education in higher education. |
| **Current control** | Presentations, essay, Semester works 1,2,3, Midterm control 1,2, tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Ахметова Т.К., Исаева З.А. Педагогика: Учебник для магистратуры университетов. - Алматы: Казак университеті, 2006. - 328 с. 2. Мынбаева А.К. Основы педагогики высшей школы: Учебное пособие. - Алматы, 2008. - 144 с. 3. Таубаева Ш.Т. Введение в методологию и методику педагогического исследования. – Туркистан: Туран, 2007. – 190 с. 4. Мынбаева А.К., Садвакасова З.М. Инновационные методы обучения, или как интересно преподавать. – Алматы, 2012. – 233 с. 5. Блинов, В. И. Методика преподавания в высшей школе: учебно-практическое пособие / В. И. Блинов, В. Г. Виненко, И. С. Сергеев. — Москва.: Издательство Юрайт, 2018. — 315 с. 6. Технология форсайт и цифровизация в интеграции образования, науки и производства: Монография/ Под ред. С.С. Сагинтаевой. -Алматы: Printexpress, 2020. - 182с. 7. Саньярова, Н.С. Педагогика (для магистрантов): учеб.пособие / Н.С. Саньярова; НАО АУЭС. - Алматы: АУЭС, 2013.- 406с. 8. Обеспечение и оценка качества аэрокосмического образования.- М.: МАИ, 2013.- 552с. 9. Новые образовательные технологии в инженерии/ Под ред. А.Н. Геращенко.- М.: МАИ-ПРИНТ, 2012.-416с. |

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| **Module name** | **MRET-M4 "Psychology of Management"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Senior lecturer Ashirbaeva Nazilya Nurkanatovna (rus.)  Senior lecturer Ashirbaeva Nazilya Nurkanatovna (kaz.), (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Lectures, practical seminars, semester works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 90 hours  **Class hours:**  Lectures -15 hours; Practice - 15 hours; SSW – 54 (MSWS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Module of social-political knowledge (cultural studies and psychology) |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Training in the basics of psychology in the management system, expanding professional opportunities in terms of the application of psychological knowledge in the field of managerial activity.  **LEARNING OUTCOMES:**  **Graduate students know:**   * the social-psychological nature of managerial activity; * properties of psychological processes included in cognitive activity; content and specifics of psychological influence   **Are able to:**   * form decisions on the effective application of modern methods and techniques of management psychology in the organization; * form decisions on the use of necessary psychological and methodological resources for managerial activity; * form decisions on the application of adequate psychodiagnostic methods of research of personality and group**.**   **COMPETENCES:**   * Demonstrate experience in developing programs to resolve conflict situations in society, including in the professional community; * Demonstrate experience in correctly expressing and arguing one's own opinion on issues of social significance. |
| **Content** | Basic methodological provisions of psychological science, its basic patterns, principles in the learning processes, didactics, systemic, activity, technological and person-oriented approaches as a methodology of psychology, as well as methods, problems and prospects for its development are presented; |
| **Current control** | Presentations, Essay, Semester works 1,2, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Годфруа Ж. «Что такое психология». Том 1. – М.: Мир, 2005 – 496 с. 2. Годфруа Ж. «Что такое психология». Том 2. – М.: Мир, 2005 – 276 с. 3. Даниел Гоулман. «Эмоциональный интеллект. Почему он может значить больше, чем IQ». Изд-во Манн, Иванов и Фербер: 2018. -560 с. 4. Джакупов С.М. «Введение в общую психологию». – А.: Қазақ университеті, 2014 5. Ильин Е.П. «Психология общения и межличностных отношений». - СПб.: Питер, 2009. - 576 с. 6. 6. Майерс Д. «Психология» / пер. с англ. И.А. Карпиков, В.А. Старовойтова. – 4-е изд. - Минск: «Попурри», 2009. – 848 с. 7. Саньярова, Н.С. Учебник "Психология для магистрантов": Теоретические и практические основы психологии в системе профессиональной подготовки кадров. - Германия: PalmariumAcademicPudlishing, 2012. - 347с. 8. Саньярова Н.С. Психология и этика делового общения. Ч.1.-А.: «Туран», 2011 9. Саньярова Н.С. Психология и этика делового общения. Ч.2.-А.: «Туран»,2 011 |

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| **Module name** | **MRET-M5-1 "Modern Measurement Methods in Telecommunications"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Professor Chezhimbaeva Katipa Slambayevna (Rus.)  (Kaz)  (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Modern methods of measurement in Radio Electronics" |
| **Teaching methods** | Lectures, laboratory works, course work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Bachelor's degree courses |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to teach a master's student methods of carrying out various measurement technologies on communication networks in different signal propagation environments  **LEARNING OUTCOMES:**  **Graduate students know:**  **-**Bases of measurements of telecommunication systems;  -Methods and means of measuring equipment of telecommunication systems;  -Methods of theoretical and experimental research in the field of communication engineering;  -methods of estimating the parameters of communication devices and systems;  -advanced methods of technical control and diagnostics in the process of adjustment and operation of communications equipment;  **Are able to:**  - correctly calculate, analyze and develop tasks related to measuring technologies of telecommunication networks,  -to carry out reliability analysis and diagnostic schemes of telecommunication systems and communications equipment;  -to carry out technical control and diagnostics in the process of adjustment and technical operation of communication systems and devices.  **COMPETENCES:**  - Demonstrate independent determination of the goals of professional activity and choose adequate methods and means of their achievement. To carry out scientific, innovative activities to acquire new knowledge. |
| **Content** | The "Modern Methods of Measurement in Telecommunications" discipline is included in the curricula as a special discipline and is designed to prepare undergraduates for independent activities as technical experts in operational measurements of transmission systems, measurements of subscriber cable systems, maintenance of equipment and SDH network, measurements in different parts of the modern telecommunications system, quality control of telecommunications services. |
| **Current control** | Course work, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base. |
| **References** | [Алексеев Е.Б.,](http://www.techbook.ru/book_list.php?str_author=%D0%90%D0%BB%D0%B5%D0%BA%D1%81%D0%B5%D0%B5%D0%B2%20%D0%95.%D0%91.) [Гордиенко В.Н.,](http://www.techbook.ru/book_list.php?str_author=%D0%93%D0%BE%D1%80%D0%B4%D0%B8%D0%B5%D0%BD%D0%BA%D0%BE%20%D0%92.%D0%9D.) [Крухмалев В.В.,](http://www.techbook.ru/book_list.php?str_author=%D0%9A%D1%80%D1%83%D1%85%D0%BC%D0%B0%D0%BB%D0%B5%D0%B2%20%D0%92.%D0%92." \o "Найти книги автора Крухмалев В.В.) [Моченов А.Д.,](http://www.techbook.ru/book_list.php?str_author=%D0%9C%D0%BE%D1%87%D0%B5%D0%BD%D0%BE%D0%B2%20%D0%90.%D0%94." \o "Найти книги автора Моченов А.Д.) [Тверецкий М.С.](http://www.techbook.ru/book_list.php?str_author=%D0%A2%D0%B2%D0%B5%D1%80%D0%B5%D1%86%D0%BA%D0%B8%D0%B9%20%D0%9C.%D0%A1." \o "Найти книги автора Тверецкий М.С.) Проектирование и техническая эксплуатация цифровых телекоммуникационных систем и сетей. Учебное пособие для вузов. Под ред. В.Н. Гордиенко, М.С. Тверецкого. 2-е изд., испр. -2017.-392 стр.  1. Аминев, А.В. А62 Измерения в телекоммуникационных системах : учебное пособие / А.В. Аминев, А.В. Блохин. — Екатеринбург : Изд-во Урал. ун-та, 2015. — 224 с. 2. Клочковская Л.П., Самоделкина С.В. Современные методы измерений в телекоммуникационных системах. Сборник задач для магистрантов специальности 6М071900 – Радиотехника, электроника и телекоммуникации. – Алматы: АУЭС, 2013, - 53 с. 3. Самоделкина С.В., Коньшин С.В. Методы и средства измерений в телекоммуникационных системах. Учебное пособие. – АУЭС, Алматы, 2013 г., - 79с. 4. Самоделкина С.В., Барсегянц К.В. Современные методы измерения в телекоммуникационных системах. Конспект лекций для магистрантов специальности 6М071900 – Радиотехника, электроника и телекоммуникации. – Алматы: АУЭС, 2013 – 67 с. 5. Барсегянц К.В., Самоделкина С.В. Современные методы измерений в телекоммуникационных системах. Методические указания к выполнению расчетно-графических работ для магистрантов специальности 6М071900 – Радиотехника, электроника и телекоммуникации. – Алматы: АУЭС, 2013 – 27. 6. Методы и средства измерения в телекоммуникационных системах. Методические указания к выполнению расчетно-графических работ. Клочковская Л.П., Самоделкина С.В. – Алматы: АУЭС,2010. 7. Самоделкина С.В., Барсегянц К.В. Методы и средства измерения в телекоммуникационных системах. Конспект лекций для магистрантов специальности 6М071900 – Радиотехника, электроника и телекоммуникации. – Алматы: АУЭС, 2011 – 72 с. 8. Методы и средства измерения в телекоммуникациях. Методические указания к выполнению лабораторных работ. Елизарова Е.Ю. – Алматы: АУЭС.-2011. 9. Методы и средства измерений в телекоммуникационных системах [Э. Ф.](http://www.livelib.ru/author/419564) [Хамадулин](http://www.livelib.ru/author/419564) – Изд. Юрайт. 2009.-368с. 10. Иванов А.Б. Волоконная оптика: компоненты, системы передачи, измерения - М.: Компания САЙРУС СИСТЕМС, 2006.-460с. 11. Контроль качества в телекоммуникационных системах / Под ред. Иванова А.Б.- М.: Компания САЙРУС СИСТЕМС, 2007. -336 с. |

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| **Module name** | **MRET-M5-2 "Modern Measurement Methods in Radio Electronics"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Professor Chezhimbaeva Katipa Slambayevna (Rus.)  (Kaz)  (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Modern methods of measurement in Telecommunications" |
| **Teaching methods** | Lectures, practical seminars, laboratory works, course work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Bachelor's degree courses |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Развитие у магистрантов способности применения различных методов измерений в радиоэлектронике.  **LEARNING OUTCOMES:**  **Graduate students know:**  **-** the main directions of measurements of radio electronic systems;  - methods and means of measuring equipment of radio electronic systems;  - methods of theoretical and experimental research in the field of radio electronics;  - methods of estimating the parameters of radio electronic devices;  **Are able to:**  - demonstrate knowledge in solving problems related to measurement technology of radio electronic networks;  - analyze the reliability and schematics of radio electronic systems and communications;  - carry out technical control and diagnostics in the process of adjustment and technical operation of radio electronic systems and devices.  **COMPETENCES:**  - Demonstrate measurement skills in radio electronic communication networks;  - Demonstrate skills in the operation of measuring equipment;  - Demonstrate knowledge of the methodology of measurement of digital channels parameters;  - Demonstrate knowledge of methods of control of channel parameters;  Demonstrate skills in analysis of telecommunication network on measuring equipment. |
| **Content** | Means and methods of measurement in various fields of telecommunications, testing, monitoring, control of modern radio electronic systems for various purposes. |
| **Current control** | Course work, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base. |
| **References** | 1. Иванов, Э.А. Методы и средства электрорадиоизмерений: учеб.пособие / Э.А. Иванов, Ш.А. Бахтаев, Е.О. Елеукулов; МОиН РК, АУЭС; под ред.Ш.А.Бахтаева. - Алматы, 2012. - 492c+30,75 п.л. 2. Электротехника және электроника негіздері: оқуқұралы / Е.Ғ. Нәдіров [ж.б.]; ҚРБжҒММ. - Алматы: Бастау, 2012. - 588б. 3. Метрология и электрорадиоизмерения в телекоммуникационных системах: учеб.пособие /С.И. Боридько, Н.В. Дементьев, Б.Н. Тихонов и др. - 2-е изд. - М.: Горячая линия-Телеком, 2012,2013 - 360с 4. Стерлинг, Дональд Дж.мл.Волоконная оптика / ж.л. Стерлинг Дональд Д. - Б.м : ЛОРИ, 2013. - 288с 5. Метрология, стандартизация, сертификация и управление качеством: Конспект лекций/ сост. С.Г. Хан. - Алматы : АУЭС, 2015. - 58с 6. Метрология, стандарттау, сертификаттау және сапаны басқару: дәрістер жинағы /құраст.: С.Г. Хан, Л.К. Ибраева. - Алматы : АЭжБУ, 2016. - 56б. 7. Латышенко К.П., Технические измерения и приборы. в 2 т: учебник. Т.1; кн.1 / К.П. Латышенко. - 23-е изд., исправ.и доп. - М.: Юрайт, 2020. - 252 с. 8. Арыстанбаев Қ.Е., Радиотехника және телекоммуникация негіздері: оқу құралы / Қ.Е. Арыстанбаев, Е.С. Серкебаев, А.С. Есенбек. - Алматы : Эверо, 2021. - 236 б. |

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| **Module name** | **MRET-M6-1 "Mathematical Processing of Measurement Results in Telecommunication Systems"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Cand.ph.-m.sc, Associate Professor Khizirova Mukhabbat Abdisattarovna (Rus.) (Kaz) (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Mathematical Processing of Measurement Results in Radio electronic Systems". |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Bachelor's degree courses |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Training undergraduates for industrial and scientific activities associated with the creation and operation of new types of telecommunications equipment, automated control systems for various purposes, the accuracy and reliability of which are increasingly highly required.  **LEARNING OUTCOMES:**  **Graduate students know:**  - issues of optimization of communication systems;  - methods of increasing transmission fidelity and reliability of TCS;  - basics of telecommunication systems measurements;  - methods of theoretical and experimental research in the field of communication engineering;  - assessment methods of the parameters of communication devices and systems;  - advanced methods of technical control and diagnostics in the process of adjustment and operation of communication equipment.  **Are able to:**   * take into account the world experience in matters of technical regulation, metrological support and life safety in the development and operation of telecommunication networks and systems.   **COMPETENCES:**   * Demonstrate the skills to optimize communication systems; * Demonstrate skills in the use of modern methods of technical control and diagnostics in the process of setting up and operating communications equipment. |
| **Content** | Static errors of measurement. Types of errors. The random error of a single measurement. Random error of average value. Systematic error. Ways of measurement result processing with statistical errors, taken into account. Testing the hypothesis of normality of distribution. Coarse measurement errors and their sifting out. Linear regression Linear correlation. Automatic error correction. Dynamic measurement errors. Measurement as a process of signal transmission. Signals and their mathematical description. Time characteristics of deterministic signals. Time characteristics of stochastic signals. |
| **Current control** | Calculation and graphic works 1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base. |
| **References** | 1. Хамадулин Э.Ф. Методы и средства измерений в телекоммуникационных системах.– М.: «Юрайт» Высшее образование, 2009. – 365 с. 2. Худяков Г.И. Статистическая теория радиотехнических систем. - М.: Акдемия, 2009. 3. Ганеев Р.М Математическое моделирование в задачах обработки сигналов – М.: Акдемия, 2011. 4. Боридько С.И., Дементьев Н.В., Тихонов Б.Н., Ходжаев И.А. Метрология и электроизмерения в телекоммуникационных системах. – М.: Горячая линия – Телеком, 2013. – 360 с. |

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| **Module name** | **MRET-M6-2 "Mathematical Processing of Measurement Results in Radio Electronic Systems"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | Cand.ph.-m.sc, Associate Professor Khizirova Mukhabbat Abdisattarovna (Rus.) (Kaz) (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Mathematical Processing of Measurement Results in Telecommunication Systems". |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Bachelor's degree courses |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Training master's students for production and scientific activities related to the creation and operation of new types of radio electronic equipment, automated control systems for various purposes, the accuracy and reliability of which are becoming more and more demanding.  **LEARNING OUTCOMES:**  **Graduate students know:**  - issues of optimization of radio electronic communication systems;  - methods of increasing the reliability of radio electronic systems;  - basics of measuring radio electronic systems;  - methods of theoretical and experimental research in the field of communication engineering;  **Are able to:**   * carry out the design and technical justification of new objects in radio electronic systems; * carry out reliability analysis and diagnostic schemes of radio electronic systems and communications equipment; * carry out technical control and diagnostics in the process of adjustment and technical operation of radio electronic systems and devices.   **COMPETENCES:**   * Demonstrate skills to optimize radio electronic communication systems; * Demonstrate skills in using modern methods of technical control and diagnostics in the process of setting up and operating radio electronic means of communication. |
| **Content** | Automated control systems for various purposes in radio electronics, methods for assessing the parameters of communication devices and systems, methods of theoretical and experimental research in the field of communication engineering, methods to improve the reliability and validity of measurement results, methods of technical control and diagnostics. |
| **Current control** | Calculation and graphic works 1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base. |
| **References** | 1. Метрология, стандартизация, сертификация и управление качеством: Конспект лекций/ сост. С.Г. Хан. - Алматы : АУЭС, 2015. - 58с. 2. Метрология, стандарттау, сертификаттау және сапаны басқару: дәрістер жинағы /құраст.: С.Г. Хан, Л.К. Ибраева. - Алматы: АЭжБУ, 2016. - 56б. 3. Гадзиковский, В.И.Цифровая обработка сигналов: учеб.пособие для студ. вузов. – М.: Солон-Пресс, 2013. - 766с. 4. Иванов, Э.А. Методы и средства электрорадиоизмерений: учеб.пособие / Э.А. Иванов, Ш.А. Бахтаев, Е.О. Елеукулов; МОиН РК, АУЭС; под ред.Ш.А.Бахтаева. - Алматы, 2012. - 492c. 5. Метрология и электрорадиоизмерения в телекоммуникационных системах: учебное пособие / С.И. Боридькои др. - 2-е изд. - М.: Горячая линия-Телеком, 2012,2013. - 360с. 6. Обработка многомерных сигналов 4: В 2-х кн. Кн.1: Линейная многомерная дискретная обработка сигналов. Методы анализа и синтеза / А.В. Богословский, Е.А. Богословский, И.В. Жигулина и др. - М. : Радиотехника, 2013. - 168с. 7. Обработка многомерных сигналов. Кн.2: Нелинейная многомерная обработка сигналов спутниковых радионавигационных систем в комплексах самолетовождения. - М. : Радиотехника, 2013. - 176с. 8. Аминев А. В., Измерения в телекоммуникационных системах : учеб. пособие для вузов / А.В. Аминев, А.В. Блохин; под ред. А. В. Блохина. - М : Юрайт, 2020. - 223 с. 9. Аминев А. В., Основы радиоэлектроники: измерения в телекоммуникационных системах : учеб. пособие для СПО / А.В. Аминев, А.В. Блохин; Уральский Федеральный ун-т имени первого Президента России Б. Н. Ельцина; под ред. А.В. Блохинаа. - М.: Юрайт, 2020. - 223 с. - (Профессиональное образование) 10. Арыстанбаев Қ.Е., Электрондық және өлшеу техникасының негіздері: оқу құралы / Қ.Е. Арыстанбаев, А.И. Амирбекова, А.К. Култас. - Алматы : Эверо, 2021. - 172 б. |

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| **Module name** | **MRET-M7-1 "Theory and Practice of Innovation in Telecommunications"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | PhD, Associate Professor Semenyakin Nikolai Vladimirovich (Rus.)  (Kaz)  (Eng) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Theory and Practice of Innovation in Radio Engineering" |
| **Teaching methods** | Lectures, calculation and graphic work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 90 hours  **Class hours:**  Lectures -30 hours; SSW – 54 (MSWS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Economics, Entrepreneurship, Leadership and Innovation |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to form the knowledge of undergraduates in the field of innovation, to adapt the system of education, communication, and the sphere of standardization to the needs of the new industrialization.  **LEARNING OUTCOMES:**  **Graduate students know:**  - theories of innovation;  - the subject of modern innovation  - the concept of "innovation and microinnovation";  - the functions of innovation;  - the subject of patent activity.  **Are able to:**  - develop interdisciplinary cooperation at the intersection of sciences;  - Implement project-oriented training courses that provide the foundations of a discipline.  **COMPETENCES:**   * To develop plans and programs for organizing innovation activities at the enterprise, conduct feasibility studies of innovation projects |
| **Content** | Basic concepts and functions of innovations, project activities as one of the most important elements of modern education, game mode of student learning, functions of competence centers, commercialization of project results. |
| **Current control** | Calculation and graphic works 1,2, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, office and special software. |
| **References** | 1. Инновационные сценарии в постиндустриальном обществе / И. Сулейменов, О. Габриелян, И. Пак, С. Панченко, Г. Мун. — Алматы–Симферополь: Print Express, 2016. — С. 218.  2. Некоторые вопросы современной теории инноваций / И. Сулейменов, О. Габриелян, Г. Мун, И. Пак, Д. Шалтыкова, С. Панченко, Е. Витулёва. — Алматы–Симферополь: Print Express, 2016. — С. 197.  3. Организация и планирование научных исследований / И. Сулейменов, О. Габриелян, В. Буряк, Н. Сафонова, Г. Ирмухаметова, Ш. Кабдушев, Г. Мун. — Алматы, Изд-во КазНУ, 2018, 336 с.  4. Сулейменов И. Э., Габриелян О.А., Седлакова З.З., Мун Г.А. История и философия науки. — Алматы, Изд-во КазНУ, 2018, 406 с.  5. Сагинтаева С.С. Наука и образование в Казахстане: зарисовки на фоне мировой турбулентности // Вестник АУЭС, 2018, спец. выпуск (мат. конф. «Роль молодежи в становлении экономики знаний»), С. 7.  6. Мун Г. А., Жанбаев Р. А. Фантомные боли мировой науки // Вестник АУЭС, 2018, спец. выпуск (мат. конф. «Роль молодежи в становлении экономики знаний»), С. 24  7. Сулейменов, И. Э., Нуртазин, А. А., Сулейменова, Р. Н., Габриелян, О. А., & Тасбулатова, З. С. (2017). НЕМОНЕТАРНАЯ МОТИВАЦИЯ ИННОВАЦИОННОЙ ДЕЯТЕЛЬНОСТИ. Образовательные ресурсы и технологии, (2 (19)).  8. Байпакбаева С.Т. Витулева Е.С. Некоторые вопросы становления энергоэффективного общества // ИЗВЕСТИЯ НАУЧНО-ТЕХНИЧЕСКОГО ОБЩЕСТВА «КАХАК», 2017, № 3 (58) |

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| **Module name** | **MRET-M7-2 "Theory and Practice of Innovative Activity in Radio Engineering"** |
| **Semester(s) in which the module is taught** | 1 |
| **Person responsible for the module** | PhD, Associate Professor Semenyakin Nikolai Vladimirovich (Rus.)  (Kaz)  (Eng) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Theory and Practice of Innovation in Telecommunications" |
| **Teaching methods** | Lectures, calculation and graphic work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 90 hours  **Class hours:**  Lectures -30 hours; SSW – 54 (MSWS -5)  **Examination preparation hours:** 6 |
| **Credits** | 3 |
| **Required and recommended prerequisites for joining the module** | Economics, Entrepreneurship, Leadership and Innovation |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** study of innovative activities in the field of research in radio engineering.  **LEARNING OUTCOMES:**  **Graduate students know:**  **-** fundamentals of design and operation of innovation activities and research in the field of radio engineering systems;  - the subject of patent activity.  **Are able to:**  - plan and carry out research and innovation activities in the field of radio engineering.  **COMPETENCES:**   * To develop plans and programs for organizing innovation activities at the enterprise, conduct feasibility studies of innovation projects |
| **Content** | Basic concepts and functions of innovations, project activities, functions of competence centers, commercialization of project results. |
| **Current control** | Calculation and graphic works 1,2, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, office and special software. |
| **References** | 1. Инновационные сценарии в постиндустриальном обществе / И. Сулейменов, О. Габриелян, И. Пак, С. Панченко, Г. Мун. — Алматы–Симферополь: Print Express, 2016. — С. 218. 2. Некоторые вопросы современной теории инноваций / И. Сулейменов, О. Габриелян, Г. Мун, И. Пак, Д. Шалтыкова, С. Панченко, Е. Витулёва. — Алматы–Симферополь: Print Express, 2016. — С. 197. 3. Организация и планирование научных исследований / И. Сулейменов, О. Габриелян, В. Буряк, Н. Сафонова, Г. Ирмухаметова, Ш. Кабдушев, Г. Мун. — Алматы, Изд-во КазНУ, 2018. - 336 с. 4. Сулейменов И. Э., Габриелян О.А., Седлакова З.З., Мун Г.А. История и философия науки. — Алматы, Изд-во КазНУ, 2018. - 406 с. 5. Сагинтаева С.С. Наука и образование в Казахстане: зарисовки на фоне мировой турбулентности // Вестник АУЭС, 2018, спец. выпуск (мат. конф. «Роль молодежи в становлении экономики знаний»). - С. 7. 6. Әлинов, М.Ш. Инновациялық менеджмент: оқуқұралы; ҚРБжҒМ. - Алматы: Бастау, 2012. - 212б. 7. Алинов, М.Ш.Инновационный менеджмент: учеб.пособие; МОиН РК. - Алматы: Бастау, 2012. - 204с. |

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| **Module name** | **MRET-M8, MRET-M15, MRET-M20, MRET-M22 "Research Work of a Master Student, Including the Implementation of a Master's thesis".** |
| **Semester(s) in which the module is taught** | 1, 2, 3, 4 |
| **Person responsible for the module** | supervisor of master's thesis, scientific advisor (Russian)  supervisor of master's thesis, scientific advisor (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** |  |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 30 hours (1semester), 30 hours (2semester), 330 hours (3semester), 330 hours (4semester)  **Class hours:**  Practice -30 hours (1semester), Practice -30 hours (2semester), 330 hours (Practice -165 and Laboratory work - 165 - 3semester), 330 hours (Practice -165 and Laboratory work - 165 - 4semester) |
| **Credits** | 1, 1, 11, 11 |
| **Required and recommended prerequisites for joining the module** | * Basics of scientific research and academic writing; * History and Philosophy of Science, RWMS 1; * Scientific and technical problems of radio engineering, electronics and telecommunications, RWMS 2; Research Practice; * RWMS 3; |
| **Module objectives/intended learning outcomes** | **MRET-М8 MODULE OBJECTIVES:** setting, discussing and clarifying the task of scientific research;  **LEARNING OUTCOMES:**   * Demonstrate the search and study of scientific literature on methods of solving the problem with the compilation of a bibliography; * demonstrate the skill of compiling an analytical review of known methods; * Demonstrate the ability to choose a method for solving a problem.   **MRET-М 15 MODULE OBJECTIVES:** carrying out research work within the framework of the chosen topics, including theoretical, theoretical-experimental and/or experimental research, the results of research are reported at scientific seminars or master's scientific and technical conferences.  **LEARNING OUTCOMES:**   * Demonstrate the ability to process and analyze data; demonstrate mastery of the rules of preparing manuscripts of scientific papers for publication; * Demonstrate the ability to accumulate experience in drafting theses and reports, writing scientific articles.   **MRET-М 20 MODULE OBJECTIVES:** analysis of the results obtained in theoretical and experimental research. At this stage the title of the master's thesis is specified, its structure is formed, necessary for successful completion of the master's thesis.  **LEARNING OUTCOMES:**   * Demonstrate the ability to perform mathematical processing of results; * Demonstrate the ability to implement the results of research in the form of conference papers and articles.   **MRET-М 22 MODULE OBJECTIVES:** Integration of the educational process with the development of the professional sphere of activity in the master's training areas to ensure the formation of the master's research competencies necessary in conducting research and solving professional problems. Master's thesis design.  **LEARNING OUTCOMES:**   * Demonstrate knowledge and skills in the professional sphere of activity; * Demonstrate the ability to carry out research work; * demonstrate the ability to conduct research and solve professional problems; * demonstrate the ability to carry out and design a master's thesis. |
| **Content** |  |
| **Current control** | Supervision of research and development by the head of the master's thesis, drawing up a report |
| **Final control** | Defending the research and development report in front of the commission. |
| **Study and examination requirements** | **Requirements for successful passing of the module:**  Study of normative technical documents; laboratory equipment of the laboratories of the TCIT department; laboratory equipment of the TSRL laboratories; preparation of a presentation to defend the report on research and development. |
| **References** | 1. Магистерская диссертация: Метод. указ. к вып. курс. диссертации. Макет диссертации для профильной магистратуры и комментарии / НАО АИЭС, Каф. радиотехники, сост. О.З. Рутгайзер.- Алматы: АИЭС, 2010.- 26с. 2. Магистерская диссертация: Метод. указ. по ее содержанию, структуре и оформл. для магистрантов спец. 5В071600 - Приборостроение / НАО АУЭС, Каф. робототехники и электроники, сост.: М.Д. Адамбаев, А.М. Ауэзова.- Алматы: АУЭС, 2018.- 30 с. 3. Елфимов, В. И. Выполнение магистерской диссертации : учебно-методическое пособие / В. И. Елфимов, А. А. Калмыков, В. Ф. Кочкина. — Екатеринбург : Изд-во Урал. ун-та, 2016 — 96 с. |

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| **Module name** | **MRET-M9 "Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Professor Baikenov Alimzhan Sergeyevich (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Lectures, lab works, calculation and graphic work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; lab works - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Familiarity with scientific and technical problems of development of radio engineering, electronics and communications. The discipline allows you to develop an adequate understanding of the advanced scientific achievements of the last decade.  **LEARNING OUTCOMES:**  **Graduate students know:**   * scientific and technical problems of implementation of communication systems, radio engineering and electronics; * strategic directions in the development of communication systems and communications.   **Are able to:**  - analyze modern telecommunications systems for their use in organizing networks for transmitting information, as well as an analysis of the prospects for modern wireless technologies.  **COMPETENCES:**  Use modern achievements of science and advanced info-communication technologies, methods of theoretical and experimental research in research work in the field of engineering and technology. |
| **Content** | The information provided by the program of this discipline on modern problems of development of radio engineering, electronics and communications is designed to enable students to navigate the scientific work carried out at the forefront of these branches of knowledge. |
| **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. Гольдштейн Б.С., Кучерявый А.Е. Сети связи пост-NGN. - СПб.: БХВ-Петербург, 2013. -160 с.  2. Тихвинский В.О. Бочечка Г.С. Минов А.Бабин А. «Сети 5G: Международная стандартизация», Connect, № 1-2, 2017.  3. Тихвинский В.О. Терентьев С.В. Коваль В.А. «Сети мобильной связи 5G: технологии, архитектура и услуги», М.; Издательский дом Медиа Паблишер, 2019.-376 с.  4. Тихвинский В.О. Терентьев С.В. Айтмагамбетов А.З. «Сети мобильной связи 5G: перспективы создания и раэвития», Алматы, Казахстан, Из-во «Ак-Шагыл», 2019.-328с.  5. http://1234g.ru/5g/standartizatsiya-5g  6. https://www.opennetworking.org |

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| **Module name** | **MRET-М10 "Theory and Practice of Project Management"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Candidate of Technical Sciences, Certified Project Manager (№СРМ 00059) Aliyarova Madina Birlesovna (Russian language)  Aliyarova Madina Birlesovna (Kazakh)  Aliyarova Madina Birlesovna (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic work, Master’s self- study work under a teacher’s supervision (MSWS), project, presentation. |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -30 hours; practice – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Economics, Entrepreneurship, Leadership and Innovation |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** To form a set of theoretical knowledge and practical skills associated with the understanding of the project role in the organization, the basic provisions of the modern project management concept, project management techniques using modern tools and methods.  **LEARNING OUTCOMES:**  **Graduate students know**   * international standards in the field of project management;   modern terminology, concepts, tools, and methods applied to project management.  **Are able to:**   * Analyze the goals and interests of project stakeholders; * Define the goals, objectives, organizational structure of the project and the hierarchical structure of the work; * calculate the time and cost of the project; * determine areas of application of project management standards   **COMPETENCES:**   * demonstrate application of tools, methods, templates of project documents in project management; * demonstrate skills in organizing communication and interaction of project stakeholders, teamwork; * demonstrate decision-making tools based on assessment of external factors and assets of organizational processes; * demonstrate techniques for independent management of uncomplicated projects and effective participation in the work of a complex project management team. |
| **Content** | Upon completion of the course a graduate will be able to form an optimal set of processes and procedures for project management in relation to a particular organization, taking into account its specificity, place in the market, development strategy, which in turn will lead to improved efficiency of project management and, as a result, increase its competitiveness. |
| **Current control** | Presentation on the project by a group of developers, calculation and graphic work 1,2,3, Midterm control 1,2 - computer testing |
| **Final control** | Examination in a test form |
| **Study and examination requirements** | Timely and complete implementation of all types of work (practical, independent). - Not to be late and not to miss classes, be punctual and obligatory. The maximum grade is reduced by 10% for untimely work. - If a graduate student has to miss a final examination or a midterm for good reason, he/she must inform the instructor in advance. - In preparation for the defense of practical assignments and midterm examination, a graduate student must participate in the team formed from the study group |
| **References** | 1. Свод знаний по управлению проектами: Project Management Institute, 6 2017. 2. Agile Practice Guide / Project management Institute. 2017. 3. СТ РК ISO 21500-2014 Руководство по управлению проектами / Комитет технического регулирования и метрологии Министерства индустрии и новых технологий Республики Казахстан. 2014 4. СТ РК 2831-2016 Требования к управлению проектами / Комитет технического регулирования и метрологии Министерства индустрии и новых технологий Республики Казахстан. 2016 5. Основы индивидуальный компетенций для управления проектами, программами и портфелем. Том 1. / под ред. К.А.Сагадиева, Казахстанская ассоциация управления проектами, 2018 г. 6. Управление проектами: практика предприятий ОПК РК: учебное пособие / под ред. А.Ф. Цехового. – Нур-Султан, «Кazakhstan Partners». 2019. с. 7. Руководство SCRUM 8. Управление проектами и программами. Ершов С.В. Управление проектами и программами. Конспект лекций. – Архангельск: САФУ. 2015 – 226 с. 9. Казакова Е.И. Разработка и принятие управленческих решений. Учебнометодическое пособие. – СПб.: Отдел оперативной полиграфии НИУ ВШЭ — СанктПетербург, 2011. – 122 с. |

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| **Module name** | **MRET-M11-1 "Algorithms and Architectures for Digital Computing"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | PhD, Associate Professor Semenyakin Nikolai Vladimirovich (Rus.)  (Kaz)  (Eng) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with “Machine Learning Theory» |
| **Teaching methods** | Lectures, practical works, course work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -30 hours; practical works – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Formation of professional competencies of undergraduates, associated with the use of theoretical knowledge in the field of digital computer system architectures and data processing methods.  **LEARNING OUTCOMES:**  **Graduate students know:**  **-** methods of representing numerical information in digital computing systems;  - methods of processing numerical information in digital computing systems;  - methods of information exchange between components of digital computing systems;  - methods of analyzing big data;  - architecture of modern digital computing systems.  **Are able to:**  - Evaluate computer architectures of digital computing systems in terms of complex quality criteria;  - plan an experiment, conduct an experimental study of data, with the help of natural or simulated models of computing systems.  **COMPETENCES:**   * Demonstrate the ability of independent research work, involving the study of specific methods of analysis of computer system architectures and software functioning on them, tools and means required to solve the actual problems of software engineering; * Demonstrate the ability to formalize in the subject area, taking into account the limitations of the used research methods, the choice of rational algorithms, depending on the application features of developed programs, the possession of knowledge of the architecture of computers and computer systems. |
| **Content** | Basic algorithms used in machine learning for data analysis, missing value recovery, novelty search, data clustering, and prediction tasks. Neural network algorithms. Architectures of modern computing systems. |
| **Current control** | Course works 1,2, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, office and special software. |
| **References** | 1. Бурков А. Машинное обучение без лишних слов. – " Издательский дом Питер", 2020.  2. Кушалиева И. И. и др. ВВЕДЕНИЕ В МАШИННОЕ ОБУЧЕНИЕ И ЕГО ПРИМЕНЕНИЕ НА PYTHON //Актуальные вопросы физико-математического образования. – 2021. – С. 460-464.  3. Картынник Ю. А., Силаев С. В., Толстиков А. А. Введение в машинное обучение. – 2014..  4. Тоби Сегаран. Программируем коллективный разум / Тоби Сегаран. – Изд-во: Символ. – 2008. – 368 с.  5. Гуц А. К. Архитектура, процессор и работа квантового компьютера //Математические структуры и моделирование. – 2010. – №. 1 (21). – С. 55-64..  6. Ерохин В. В. Архитектура процессоров большой разрядности: проблемы и решения //Проблемы разработки перспективных микро-и наноэлектронных систем (МЭС). – 2020. – №. 3. – С. 158-164.  7. Клементьев И. П., Устинов В. А. Введение в Облачные вычисления. – 2016.  8. Чубахиро А., Каманде М. В. Виртуальные вычислительные сети для случая аппаратной виртуализации //Современная наука: актуальные проблемы теории и практики. Серия: Естественные и технические науки. – 2018. – №. 6. – С. 158-163. |

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| **Module name** | **MRET-M11-2 "Machine Learning Theory"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | PhD, Associate Professor Semenyakin Nikolai Vladimirovich (Rus.)  (Kaz)  (Eng) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Algorithms and architectures for digital computing » |
| **Teaching methods** | Lectures, practical works, course work, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -30 hours; practical works – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Acquisition of theoretical knowledge and practical skills in the field of research of data analysis problems and their solution by methods of machine learning.  **LEARNING OUTCOMES:**  **Graduate students know:**   * basic classes of algorithms for solving classification, clustering, and linear regression problems; * basic algorithms for finding outliers and anomalies; * probabilistic methods, application of trees in MO algorithms; * methods of applying ensembles of algorithms and feature selection.   **Are able to:**   * draw proper conclusions from comparing the results of theory and experiment; * identify practical problems for machine learning; to work with modern software complexes for solving machine learning problems; to plan the best way to conduct a computational experiment; * correctly assess the degree of reliability of the solution found.   **COMPETENCES:**   * Demonstrate independent work in modern software complexes; * Demonstrate mastery of a large volume of information; * Demonstrate the ability to solve problems using various machine learning methods. |
| **Content** | Theoretical problems of developing mathematical support for computing systems. The theory of flows in networks, analysis of algorithm complexity and complexity of discrete problems. |
| **Current control** | Course works 1,2, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, office and special software. |
| **References** | 1. Бурков А. Машинное обучение без лишних слов. – " Издательский дом Питер", 2020.  2. Кушалиева И. И. и др. ВВЕДЕНИЕ В МАШИННОЕ ОБУЧЕНИЕ И ЕГО ПРИМЕНЕНИЕ НА PYTHON //Актуальные вопросы физико-математического образования. – 2021. – С. 460-464.  3. Картынник Ю. А., Силаев С. В., Толстиков А. А. Введение в машинное обучение. – 2014.  4. Тоби Сегаран. Программируем коллективный разум / Тоби Сегаран. – Изд-во: Символ. – 2008. – 368 с.  5. Гуц А. К. Архитектура, процессор и работа квантового компьютера //Математические структуры и моделирование. – 2010. – №. 1 (21). – С. 55-64.  6. Ерохин В. В. Архитектура процессоров большой разрядности: проблемы и решения //Проблемы разработки перспективных микро-и наноэлектронных систем (МЭС). – 2020. – №. 3. – С. 158-164.  7. Клементьев И. П., Устинов В. А. Введение в Облачные вычисления. – 2016.  8. Чубахиро А., Каманде М. В. Виртуальные вычислительные сети для случая аппаратной виртуализации //Современная наука: актуальные проблемы теории и практики. Серия: Естественные и технические науки. – 2018. – №. 6. – С. 158-163. |

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| **Module name** | **MRET-М12-1 "Technologies of Digital Signal Processing in Telecommunication Systems"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Cand.ph.-m.sc, Associate Professor Khizirova Mukhabbat Abdisattarovna (Rus.) (Kaz) (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Technologies of digital signal processing in radio electronic systems» |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 15 hours; practical – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science, Basics of digital signal processing |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to study the theory of digital signal processing (DSP), modern methods of analysis and synthesis of digital circuits used in telecommunications systems and acquisition by undergraduates of practical skills of analysis and synthesis of typical digital circuits used in telecommunications systems, with their implementation in the form of appropriate algorithms.  **LEARNING OUTCOMES:**  **Graduate students know:**  - mathematical basics of digital signal processing;  - methods of describing linear discrete systems with constant parameters;  - basics of digital filters design;  - technology of discrete Fourier transform;  **Are able to:**  - perform z-transformation;  - analyze and synthesize NIR and FIR - filters;  - calculate forward and reverse discrete Fourier transforms;  **COMPETENCES:**  - Demonstrate ability to use application software packages for analysis and synthesis of radio engineering, electronics and telecommunications systems and telecommunications networks |
| **Content** | The basics of digital signal processing are presented. The main directions and algorithms of DSP, a generalized scheme of DSP, DSP tasks are considered. The analysis of the main directions of DSP. The difference equation of the digital filter. Recursive and nonrecursive filters, methods of their description Analysis of nonrecursive filters. Frequency characteristics of FIR filters with symmetrical coefficients FIR synthesis methods: the method of invariant impulse response and the method of bilinear z-transformation. FIR filters with linear FVC, the windows method, optimal (by Chebyshev) FIR filters. Quantization effects in digital systems. Noise quantization of the analog-to-digital converter (ADC) and intrinsic noise of a digital system. Digital System Dynamic Range and Scaling. Limit cycles Fundamentals of adaptive signal processing. Classification of adaptive signal processing systems. Problem statement and optimal nonrecursive estimation Multi-speed systems. Multiple rate processing concepts, sampling rate converters. Fixed-point digital signal processors. |
| **Current control** | Calculation and graphic works 1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base. |
| **References** | 1. Солонина А.И. и др. Основы цифровой обработки сигналов: курс лекций. - СПб: БХВ - Петербург, 2005. - 768 с. 2. Айфичер Эммануил, Джервис Барри. Цифровая обработка сигналов: практический подход. - М.: Издательский дом «Вильямс», 2004.- 992 с. 3. Сперанский В.С. Сигнальные микропроцессоры и их применение в системах телекоммуникаций и электроники. Учебное пособие для вузов. – М.: Горячая линия – Телеком, 2008. – 168 с. 4. Лэй Эдмунд. Цифровая обработка сигналов для инженеров и технических специалистов: практическое руководство.- М.: ООО «Группа ИДТ», 2007. – 336 с. 5. Петрищенко С.Н., Мусапирова Г.Д. Цифровая обработка сигналов. Методические указания к выполнению лабораторных работ для магистрантов по специальности 6N0719 – Радиотехника, электроника и телекоммуникации. – Алматы, 2009. – 51 с. 6. Петрищенко С.Н. Цифровая обработка сигналов. Конспект лекций для магистрантов по специальности 6М0719 – Радиотехника, электроника и телекоммуникации. – Алматы, 2009. – 36 с. 7. Петрищенко С.Н., Цифровая обработка сигналов. Методические указания на выполнение расчетно-графических работ № 1 и 2 для магистрантов по специальности 6М0719 – Радиотехника, электроника и телекоммуникации. – Алматы, 2010. – 16 с. 8. Гонсалес, Рафаэл С. Цифровая обработка изображений: пер. с англ. / С. Гонсалес Рафаэл , Е. Вудс Ричард; под ред.П.А.Чочиа. - 3-е изд.,испр.и доп. - М. : Техносфера, 2012. - 1104с. 9. Воробьёв, С.Н. Цифровая обработка сигналов: учебник для вузов. - М. : Академия, 2013. - 320с. 10. Жунусов, К.Х. Основы цифровой обработки сигналов в телекоммуникационных системах: учеб. пособие / К.Х. Жунусов, Л.И. Сарженко; МОиН РК, НАО АУЭС. - Алматы: АУЭС, 2014. - 91с. 11. Казиева, Г.С. Цифровые методы обработки сигналов в телекоммуникации: учеб. пособие / Г.С. Казиева, Л.Г. Богомолова; МОиН РК, НАО АУЭС. - Алматы: АУЭС, 2014. - 87с. 12. Красильников, В.А. Цифровая обработка 2D- и 3D-изображений: учеб.пособие / В.А. Красильников. - СПб.: БХВ-Петербург, 2011. - 608с. 13. Цифровая обработка сигналов и MATLAB: учеб.пособие /А.И. Солонина, Д.М. Клионский, Т.В. Меркучева и др.; рек.УМО. - СПб. : БХВ-Петербург, 2013. - 512с. |

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| **Module name** | **MRET-М12-2 "Technologies of Digital Signal Processing in Radio Electronic Systems"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Cand.ph.-m.sc, Associate Professor Khizirova Mukhabbat Abdisattarovna (Rus.) (Kaz) (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Technologies of digital signal processing in telecommunication systems » |
| **Teaching methods** | Lectures, practical seminars, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 15 hours; practical – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science, Basics of digital signal processing |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** study the technology of digital signal processing, modern methods of signal processing used in radio electronic systems.  **LEARNING OUTCOMES:**  **Graduate students know:**   * technological basics of using digital signal processing; * use of inverse and direct Fourier transform; * architecture of signal processors used in radio electronic systems;   **Are able to:**   * synthesize recursive and nonrecursive digital filters in radio electronic systems (RES); * program all tasks used in scientific research works   **COMPETENCES:**   * demonstrate the ability to analyze DSP device technology, interpolation and extrapolation signal processing in digital devices; * demonstrate the ability to independently perform digital signal processing to solve research and production problems using modern hardware and research methods. |
| **Content** | Fundamentals of DSP technology in radio electronic systems. Processing and analysis of types of digital filters. Solving some problems with digital signal processing. Fast Fourier transform. |
| **Current control** | Calculation and graphic works 1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base. |
| **References** | 1. Сергиенко, А.Б. Цифровая обработка сигналов: учеб.пособие. - 3-е изд. - СПб. : БХВ-Петербург, 2011. - 756с. 2. Лайонс, Ричард.Цифровая обработка сигналов: пер.с англ.; под ред.А.А.Бритова. - 2-е изд. - М.: Бином, 2011. - 654с. 3. Воробьёв, С.Н. Цифровая обработка сигналов: учебник для вузов. - М. : Академия, 2013. - 320с. 4. Казиева, Г.С. Цифровые методы обработки сигналов в телекоммуникации: учеб. пособие / Г.С. Казиева, Л.Г. Богомолова; МОиН РК, НАО АУЭС. - Алматы: АУЭС, 2014. - 87с. 5. Гадзиковский, В.И. Цифровая обработка сигналов: учеб. пособие для студ. вузов. – М.: Солон-Пресс, 2013. - 766с. 6. Гонсалес, Рафаэл С. Цифровая обработка изображений: пер. с англ. / С. Гонсалес Рафаэл , Е. Вудс Ричард; под ред.П.А.Чочиа. - 3-е изд.,испр.и доп. - М. : Техносфера, 2012. - 1104с. 7. Красильников, В.А. Цифровая обработка 2D- и 3D-изображений: учеб. пособие / В.А. Красильников. - СПб.: БХВ-Петербург, 2011. - 608с. 8. Цифровая обработка сигналов и MATLAB: учеб.пособие /А.И. Солонина, Д.М. Клионский, Т.В. Меркучева и др.; рек.УМО. - СПб. : БХВ-Петербург, 2013. - 512с. 9. Попов, О.Б. Цифровая обработка сигналов в трактах звукового вещания: учеб. пособие / О.Б. Попов, С.Г. Рихтер. - 2-е изд. стереотип. - М.: Горячая линия-Телеком, 2012. - 342с. |

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| **Module name** | **MRET-М13-1 "Internet of Things Networks and Services, M2M"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Professor Chezhimbaeva Katipa Slambayevna (Rus.)  (Kaz)  (Engl.) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with "Modern methods of measurement in Radio Electronics" |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; Laboratory work - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Mathematics 1; Mathematics 2; Information and communication technology (in English), History and Philosophy of Science |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  - basics of IoT and M2M technologies;  - some ways of practical implementation of IoT and M2M technologies on the basis of various telecommunication networks;  - peculiarities of building IoT and M2M networks;  - possible ways to provide services by IoT and M2M networks in various vertical markets;  - basics of regulatory impact on implementation and development of the Internet of Things and M2M technologies in the Republic of Kazakhstan.  **LEARNING OUTCOMES:**  **Graduate students know:**  - The principles of architecture and functional purpose of individual blocks of IoT and M2M networks;  - principles of construction and use of interface systems in IoT and M2M networks;  - comparative characteristics of radio access networks based on different radio modulation technologies;  - legislative and regulatory prerogatives when using the radio frequency resource of the Republic of Kazakhstan in the Internet of Things and M2M networks;  - construction and implementation of terminal devices (subscriber terminals) in IoT and M2M networks.  **Are able to:**  - Evaluate the effectiveness and select adequate implementation schemes for IoT and M2M networks in their application to various vertical markets;  - Identify the types of traffic and calculate the total load in IoT and M2M networks;  - Determine the security criteria for IoT and M2M traffic transmission, and build networks according to those criteria;  - Take steps to ensure that IoT and M2M networks perform as required.  **COMPETENCES:**  - Demonstrate skills to participate in the work of creating projects for the development of infocommunication infrastructure and its individual elements. |
| **Content** | This discipline presents educational lecture material, provides materials for independent work, practical exercises and coursework necessary for master students to master the basics of IoT and M2M technologies. |
| **Current control** | Calculation and graphic works,1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | PC, software, laboratory base |
| **References** | 1. Б.И.Нургожин, «Сети и услуги интернета вещей и М2М», Конспект лекций для магистрантов специальности 6M071900 – Радиотехника, электроника и телекоммуникации, 2019 г. 68 с.  2. Тихвинский В.О. Бочечка Г.С. Нургожин Б.И. Айтмагамбетов А.З. «Сети IoT/M2M:технологии, приложения и регулирование». Изд. «АК-Шагыл», Алматы, 2016г. 324 с.  3. Тихвинский В.О. Нургожин Б.И. Саргаскаев Н.Т. «Построение, управление и регулирование сетей GPRS/UMTS», Изд. «Казыгурт», Алматы, 2011г. 376 с.  4. Тихвинский В.О.Нургожин Б.И. Айтмагамбетов А.З. «Сети мобильной связи от 4G к 5G: технологии, приложения и регулирование», Изд. «Ак-Шагыл», Алматы, 2014г. 372 с.  5. David Doswarthick, Omar Elloumi, Olivier Hersent M2M communications, a systems approach//John Wiley&sons, 2012, 336p.  6. Тихвинский В.О., Бочечка Г.С. «Применение сетей М2М для построения интеллектуальных электрических сетей SmartGrid», Электросвязь, 2012г.  7. Б.Б.Кобец, И.О.Волкова «Инновационное развитие электроэнергетики на базе концепции SmartGrid», Москва, ИАЦ Энергия, 2010.-208 с.  8. M2M+ Industry Summit-2014 (http://www.m2mplusforum.com/conference-program-2014/).  9. M. Z. Shafiq, L. Ji, A. X. Liu, J. Pang, and J. Wang, ―A First Look at cellular Machine-to-Machine Traffic: Large Scale Measurement andCharacterization, ‖ in Proc. of the 12th ACM SIGMETRICS/PERFORMANCEJoint International Conference on Measurement and Modeling of Computer Systems, London, UK, 2012, pp. 65–76. |

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| **Module name** | **MRET-М13-2 "IoT with Big Data Processing"** |
| **Semester(s) in which the module is taught** | 2 |
| **Person responsible for the module** | Senior Lecturer Kumyzbaeva Saule Kassymbekovna (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Internet of Things and M2M networks and services» |
| **Teaching methods** | Lectures, laboratory works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; practice - 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Information and Communication Technology (in English), Algorithmic Programming Languages in Telecommunications, History and Philosophy of Science |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:**  formation of professional competence in the development and use of systems of processing and analysis of large arrays of data, the study of the possibility of data representation and analytical flows in IoT networks.  **LEARNING OUTCOMES:**  **Graduate students know:**   * the characteristics and requirements for specific IoT data; * ways to build a data stream to connect an IoT system or device data to the cloud in specific formats; * the possibilities of using big data tools to process IoT data in distributed computing; * opportunities to use machine learning algorithms to analyze IoT data patterns and extract information.   **Are able to:**  - design elementary IoT devices on Arduino boards: assemble circuits, program controllers;  - create a messaging and data flow system with Apache Spark, Storm, and Kafka using a hands-on approach in Amazon Web Services (AWS) with simulated data;   * conduct real-time pattern analysis with IoT data using the Hadoop ecosystem and gaining further predictive insights to create managed triggers for business applications and data mining.   **COMPETENCES:**  Demonstrate improvement and development of their intellectual and cultural level and skills to independently learn new methods of research, to change the scientific and scientific-production profile of their professional activity |
| **Content** | The basics of IoT programming on Arduino, setting up communication between a microcomputer and an active IoT device are presented. Ways to store and process big data obtained from IoT devices, the application of cloud computing IaaS, PaaS, SaaS are studied. The basic concepts of Machine Learning, KDD Technologies, CDN are studied. Distributed computing models for parallel processing of large amounts of information Hadoop, MapReduce are studied. |
| **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. Анналин Ын, Кеннет Су. Теоретический минимум в BIG DATA. Все, что вам нужно знать о больших данных. – Питер, 2019. – с. 208 2. Андреас Вайгенд. BIG DATA. Вся технология в одной книге. – Эксмо, 2018. – с.384 3. Александр Сенько. Работа с BigData в облаках. – Питер, 2018. – с. 448 4. Загоруйко Н.Г. Когнитивный анализ данных. Новосибирск: Академическое изд-во «ГЕО». -2012 . -186 с. ISBN 978-5-906284-04-4. 5. White, Hadoop: The Definitive Guide. O'Reilly Media, 2012 6. Интернет вещей (IoT). Что это и почему это важно. SAS. <https://www.sas.com/ru_ru/insights/big-data/internet-of-things.html> 7. <https://www.ck12.org/c/statistics/?referrer=special> 8. <https://portal.aues.kz/course/view.php?id=1446> 9. Lectures on scientific computing with Python. В свободном доступе: <URL:https://github.com/jrjohansson/scientific-python-lectures> 10. Python. The official Python web site. В свободном доступе: URL: <https://www.python.org/> 11. Пакет NumPy. Краткое введение: URL: В свободном доступе: <http://pyviy.blogspot.ru/2009/09/numpy.html> 12. Мерков, Александр Борисович. Распознавание образов: введение в методы статистического обучения / А.Б. Мерков; Рос. акад. наук, Ин-т систем. анализа.— Москва: УРСС=URSS, 2010.— 254с.:ил. (<URL:http://www.recognition.mccme.ru/pub/RecognitionLab.html/slbook.pdf>) |

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| **Module name** | **MRET-М14**, **MRET-М21 "Research Practice"** |
| **Semester(s) in which the module is taught** | 2 и 4 |
| **Person responsible for the module** | supervisor of master's thesis, scientific advisor (Russian)  supervisor of master's thesis, scientific advisor (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** | research and experimental studies at the production and laboratories of AUES (specialized TNIL) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 120 hours (2semester), 210 hours (4semester)  **Class hours:**  Practice -60 hours, Laboratory classes -(60+210) |
| **Credits** | 4 (semester), 7 (4 semester) |
| **Required and recommended prerequisites for joining the module** | Since the content of the research practice is determined by the topic of the thesis research a Master student must first study literature and patent sources on the topic being developed to use them when carrying out qualification work at the enterprise and issues of occupational health and safety. |
| **Module objectives/intended learning outcomes** | **MRET-М 14 MODULE OBJECTIVES:** Familiarization with the latest theoretical, methodological, and technological achievements of domestic and foreign science, with modern methods of scientific research, processing, and interpretation of experimental data.  **MRET-М 21 MODULE OBJECTIVES:** study of the activities of enterprises and organizations in accordance with the topic of the master's thesis: description of the object and subject of research; collection and analysis of information about the subject of research; study of individual aspects of the problem under consideration; analysis of scientific literature using various methods of access to information; with a summary of the material collected in accordance with the practice program.  **LEARNING OUTCOMES:**  **Demonstrate** the ability to use in practice skills and abilities in research and scientific and production work organization, the ability and willingness to apply modern research methods, conduct technical tests and (or) scientific experiments, to evaluate the results of the work performed.  **Demonstrate** the ability to conduct research and experimental work for technical systems and technological processes using the necessary methods and means of control, monitoring and analysis  **Use** in-depth theoretical and practical knowledge that is at the cutting edge of science and technology in the professional field. |
| **Content** | The content of the research practice is determined by the topic of dissertation research. The research practice systematizes, expands, and consolidates professional knowledge, forms the skills of conducting independent scientific work, research and experimentation. |
| **Current control** | Control of the internship tasks execution according to the Internship Diary by the supervisor of the internship from the university |
| **Final control** | Defending the practice report in front of the commission |
| **Study and examination requirements** | **Requirements for successful module completion:**  Laboratory equipment, preparing a presentation for the report defense |
| **References** | 1. Special literature on the topic of dissertation research  2. Хан С.Г. Методические указания по организации и проведению профессиональной практики по группе образовательных программ послевузовского образования «Автоматизация и управление» для магистрантов ОП «Автоматизация и управление». – Алматы: АУЭС, 2020. – с. 20. |

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| **Module name** | **MRET-М16-1 "Research of Transport Communication Networks Technologies"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor Baikenov Alimzhan Sergeyevich (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «A study of modern transport communication networks» |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; laboratory works – 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science; Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** Mastery of knowledge of modern science and advanced transport communication technologies, methods of theoretical and experimental study in research work in the field of telecommunications  **LEARNING OUTCOMES:**  **Graduate students know:**   * the principles of modern digital transport communication networks; * methods of describing transport digital communication networks, digital methods of transmitting information; * multiplexing systems and their interaction between each other; * the main directions and prospects for the development of transport networks; * the main parameters and requirements for transport communication networks; * methods of management of transport communication networks;   **Are able to:**   * analyze the processes taking place in transport communication networks; * evaluate the effectiveness of transport networks for specific applications; * calculate the parameters and choice of the main elements of transport communication networks.   **COMPETENCES:**   * use modern achievements of science and advanced info-communication technologies, methods of theoretical and experimental research in research works in the field of engineering and technology; * demonstrate knowledge of the general methodology of professional activity in the field of design and quality assurance in modern transport networks. |
| **Content** | The information provided by the program of this discipline regarding modern problems of development of modern transport communication networks is designed to enable students to navigate the scientific work carried out at the forefront of these branches of knowledge. |
| **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. Фокин В.Г. Когерентные оптические сети. Учебное пособие. СибГУТИ, 2015.-371с.  2. Vinod Mishra Software Defined Network. Copyright © Momentum Press®, LLC, 2019.-104 p.  3. Р.Фриман Волоконно-оптические системы связи. /2-е изд., М.: Мир Электроники, 2012.-312 с.  4. <https://ores.su/ru/journals/informatika-telekommunikatsii-upravlenie/>  5. <http://window.edu.ru/resource/710/6710>  6. <http://libr.aues.kz/facultet/frts/kaf_aes/18/umm/aes_1.htm>  7. <http://libr.aues.kz/alphabet/teachers/index.php?id=91> |

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| **Module name** | **MRET-М16-2 "Research of Modern Transport Communication Networks"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Professor Baikenov Alimzhan Sergeyevich (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Research on transport communication network technologies» |
| **Teaching methods** | Lectures, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; laboratory works – 30 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science; Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** training of master's students with basic knowledge in the field of modern transportation networks**.**  **LEARNING OUTCOMES:**  **Graduate students know:**   * the principles of building modern transport communication networks; * multiplexing systems and their interaction with each other; * the main directions and prospects for the development of modern transport communications networks; * the main parameters and requirements for modern transport communication networks; * methods of management of modern transport communication networks;   **Are able to:**   * analyze the functioning of modern digital transport communication network technologies and their work effectiveness under specific conditions.   **COMPETENCES:**   * Demonstrate the ability to navigate modern information transport networks and adapt to dynamically changing processes in telecommunications; * Demonstrate the ability to be flexible and mobile in a variety of professional settings. |
| **Content** | Models of transport networks. Multiplexing and transmission technologies in transport networks. Network elements of optical transport networks. Structures, protection, synchronization, and control in optical transport networks. Transport network structures, standard control network elements. OTN optical transport network technology. MPLS technology. Technological solution for T-MPLS. Family of transport technologies WDM. IP/DWDM Technology |
| **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. Фокин В.Г. Когерентные оптические сети. Учебное пособие. СибГУТИ, 2015.-371с.  2. Vinod Mishra Software Defined Network. Copyright © Momentum Press®, LLC, 2019.-104 p.  3. Олифер, В.Г. Компьютерные сети. Принципы, технологии, протоколы: учебник / В.Г. Олифер, Н.А. Олифер.- 4-е изд.- СПб.: Питер, 2013.- 944с.  Р. Фриман Волоконно-оптические системы связи. /2-е изд., М.: Мир Электроники, 2012.-312 с.  4. <https://ores.su/ru/journals/informatika-telekommunikatsii-upravlenie/>  5. <http://window.edu.ru/resource/710/6710>  6. <http://libr.aues.kz/facultet/frts/kaf_aes/18/umm/aes_1.htm>  7. <http://libr.aues.kz/alphabet/teachers/index.php?id=91> |

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| **Module name** | **MRET-М17-1 "Intelligent Networks"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Associate Professor Yerzhan Asel Anuarkyzy (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «**Sensor networks**» |
| **Teaching methods** | Lectures, practical classes, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; practical classes – 15 hours; laboratory works – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science; Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** formation of research knowledge, development, operation, principles of organization and functioning of intelligent networks being a modern concept of development of telecommunication services.  **LEARNING OUTCOMES:**  **Graduate students know:**   * concepts and features of artificial intelligence (AI) systems; * software tools for designing intelligent systems; * characteristics and equipment of intelligent networks; * principles of organization and functioning, requirements in general for intelligent networks;   **Are able to:**   * recommend the architecture for building an intelligent network for an enterprise or organization, as well as the necessary list of services provided and the opportunities to expand their range; * formulate the basic technical requirements for smart grid equipment;   **COMPETENCES:**   * Demonstrate the ability to analyze the architecture of building an intelligent network for an enterprise or organization; * demonstrate proficiency in practical implementation of smart grids and most common services; * Demonstrate proficiency in software tools for designing intelligent systems (IS) for various subject areas: energy, education, business, etc. |
| **Content** | Artificial Intelligence Systems. Software tools for constructing intelligent systems. Architectures, protocols, and interfaces of intelligent networks. Practical realization of intelligent networks and the most common services. Directions, perspectives of networks development, potentialities of intellectual networks in the era of networks and services convergence. |
| **Current control** | Calculation and graphic works 1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Искусственный интеллект как драйвер четвертой технологической революции: учеб. пособие для магистрантов / М.Н. Калимолдаев, Г.А. Мун, И.Т. Пак и др.; МОН РК, Ин-т информационных и вычислительных технологий, АУЭС, КазНУ им. аль-Фараби. - Алматы: Полиграфкомбинат, 2018. - 314 с. 2. Советов, Б.Я. Интеллектуальные системы и технологии: учебник для вузов / Б.Я. Советов, В.В. Цехановский, В.Д. Чертовской. - М.: Академия, 2013. - 320с. 3. Сулейменов, Б.А. Методы искусственного интеллекта в управлении и диагностике технических систем / Б.А. Сулейменов, Ж.Ж. Омирбекова, А.Б. Сулейменов; МОиН РК, КазНИТУ им. К.И. Сатпаева. - Алматы: КазНИТУ, 2017. - 320с. 4. Абденов А.Ж., Интеллектуальные сервисы по управлению информацией и событиями безопасности в компьютерных системах и сетях : учеб. пособие / А.Ж. Абденов, А.А. Абденова. - Алматы : Эверо, 2021. - 152 с. 5. Яворский В.В., Интеллектуальные информационные технологии : учебник / В.В. Яворский. - Алматы : Эверо, 2021. - 344 с. 6. Нугуманова А.Б., Интеллектуальный анализ данных : учеб. пособие / А.Б. Нугуманова, М.Е. Мансурова. - Алматы : Эверо, 2021. - 172б. 7. Остроух А.В., Интеллектуальные информационные системы и технологии: монография / А.В. Остроух, А.Б. Николаев. - СПб.: Лань, 2019. - 308 с. 8. Трофимов В.Б., Интеллектуальные автоматизированные системы управления технологическими объектами: учеб. пособие / В.Б. Трофимов, С.М. Кулаков. - 2-е изд., испр. - М.: Инфра-Инженерия; Вологда, 2020. - 256с. |

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| **Module name** | **MRET-М17-2 "Sensor Networks"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Associate Professor Yerzhan Asel Anuarkyzy (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «**Smart grids**» |
| **Teaching methods** | Lectures, practical classes, laboratory works, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -15 hours; practical classes – 15 hours; laboratory works – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science; Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications. |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES: studying the scientific foundations of building modern sensor networks for various purposes**  **LEARNING OUTCOMES:**  **Graduate students know:**   * scientific development directions of modern automated measuring instruments for data collection and processing; general approaches to analysis and synthesis of systems; scientific principles of construction and operation of sensor networks;   **Are able to:**   * determine the main characteristics of modern sensor networks, feasibility and prospects of their use for solving specific problems.   **COMPETENCES:**   * Demonstrate the ability to apply sensor networks in various fields of science and technology in modern conditions of informatization and computerization of society; * Demonstrate the ability to master the principles of sensor networks, technical characteristics, and design features of developed and used communication networks. |
| **Content** | The information on sensory networks provided by the program of this discipline is designed to enable the graduate to navigate the scientific problems standing in the way of further development of science in the field of sensory networks and systems.  The course allows you to develop ideas about the advanced scientific achievements and world scientific research in the field of sensor networks. |
| **Current control** | Calculation and graphic works 1,2,3, Midterm control 1,2, Tests |
| **Final control** | Examination |
| **Study and examination requirements** | Personal computer, software. |
| **References** | 1. Беспроводные сенсорные сети. Учебное пособие для вузов./ Под общей редакцией Б. Я. Лихтциндера.-СПб. 2020 г. 236с. 2. Иванов И.Э. Проблемно-ориентированные сенсорные сети: практический подход./Под редакцией Чье Ен Ун. – Хабаровск. 2015г. 219с. 3. Калачев А.В. Аппаратные и программные решения для беспроводных сенсорных сетей. – Москва: Национальный открытый университет . 2014г. 218с. |

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| **Module name** | **MRET-М18-1 "Convergence of Telecommunications Services"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Doctor of Engineering, Professor Mubarak Zakhidovna Yakubova (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «Modern mobile communication systems » |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -30 hours; practical seminars – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | History and Philosophy of Science; Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** the knowledge of telecommunications service convergence, which means the process of gradual convergence of different telecommunications technologies and services to unify equipment and expand functionality.  **LEARNING OUTCOMES:**  **Graduate students know:**   * basic concepts of convergence of telecommunication services in radio electronics; * formalized description of service processes in switching systems and communication networks in the convergence of services; * the principles of modeling of switching systems based on Markov processes in the convergence of telecommunication services in radio electronics; * calculation methods of converged networks capacity and evaluation of their service quality, and others;   **Are able to:**   * analyze qualitative indicators to carry out the calculation of load and equipment forecasting in networks with converged telecommunication services; * solve practical problems using modern numerical and engineering methods based on computer technology;   **COMPETENCES:**  - Demonstrate skills to participate in the work of creating projects for the development of infocommunication infrastructure and its individual elements |
| **Content** | Advances in the convergence of telecommunications services in recent years, as well as the neural networks application for management in telecommunications and their various services |
| **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. Головицына, М.В. Проектирование радиоэлектронных средств на основе современных информационных технологий: учебное пособие. - М.: Интернет Ун-т Информ. Технологий, 2011. - 503с. 2. Гольдштейн, Б.С.Сети связи: учебник / Б.С. Гольдштейн, Н.А. Соколов, Г.Г. Яновский. - СПб.: БХВ-Петербург, 2011. - 400с. 3. Гольдштейн, Б.С. Сети связи пост-NGN / Б.С. Гольдштейн, А.Е. Кучерявый. - СПб.: БХВ-Петербург, 2013. - 160с. 4. Конвергенция мобильных и стационарных сетей следующего поколения: пер. с англ / под ред. А.Е. Давыдова, К.Иньевски. - М.: Техносфера, 2012. - 808с. 5. Якубова, М.З. Конвергенция телекоммуникационных услуг: учеб.пособие / М.З. Якубова, Ш.А. Мирзакулова; МОН РК, НАО АУЭС. - Алматы: Альманах, 2018. - 72с. 6. Радиотехника мен телекоммуникациялар негіздері: оқуқұралы / А.М. Достиярова, А.А. Куликов, Р.Т. Сафин ж.б. - Алматы: Нур-Принт, 2015. - 155б. 7. Сигналдарды қабылдау және өңдеу. Тапсырмалар және жаттығулар жинағы: оқу құралы / У.С. Байдельдинов, С.К. Султангазинов, В.В. Артюхин ж.б. - Алматы : ҚҚЖУ, 2012. - 354б. 8. Телекоммуникациялық қызметтердің конвергенциясы [Мәтін]: Оқу құралы / М.З. Якубова, Ш.А. Мирзакулова, Т.В. Голубева; ҚР БжҒМ, КЕАҚ АЭжБУ.- Алматы: АЭжБУ, 2018.- 72 б. |

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| **Module name** | **MRET-М18-2 "Modern Mobile Communication Systems"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | Cand. Ph.math.sc, Associate Professor Khizirova Mukhabbat Abdisattarovna (Russian)  (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Elective with «convergence of telecommunications services» |
| **Teaching methods** | Lectures, practical seminars, calculation and graphic works, Master’s self- study work under a teacher’s supervision (MSWS) |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 150 hours  **Class hours:**  Lectures -30 hours; practical seminars – 15 hours; SSW – 99 (MSWS -15)  **Examination preparation hours:** 6 |
| **Credits** | 5 |
| **Required and recommended prerequisites for joining the module** | Scientific and Technical Problems of Radio Engineering, Electronics and Telecommunications |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** to acquire knowledge on the peculiarities of construction and functioning of radio access networks and base mobile networks in the development from 2G to 4G; possibilities of providing a wide range of infocommunication services on their basis for voice and data transmission; prospects for their further development, including up to 5G technology.  **LEARNING OUTCOMES:**  **Graduate students know:**   * general principles and technological features of the construction and operation of mobile networks of different generations, the possibility of providing services on their basis; * procedures for legislative and regulatory environment of radio communication network operation and use of the radio frequency spectrum; * the prospects for further development of mobile communications to the 5G level;   **Are able to:**   * work independently with technical literature and instructions for operating mobile communication equipment; * understand algorithms and software products used in mobile communication interfaces; * competently comply with legislative and regulatory environment for the operation of radio equipment and the use of the radio frequency spectrum;   **COMPETENCES:**  - Demonstrate skills to participate in the work of creating projects for the development of infocommunication infrastructure and its individual elements |
| **Content** | The history of development and generations of cellular communication are presented. Modern radio communication systems. General principle and architecture of construction. Ways to counteract negative influences on the radio signal. Organization of cellular networks. Organization of LTE networks. Principles of construction and operation of LTE networks. Organization of wireless networks. Equipment and modes of operation modes and peculiarities of their organization. The organization and planning of wireless networks. An overview of D-LINK wireless equipment. Security of wireless networks. The basics of wireless network security protocols and cryptography. |
| **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 Бабков, В. Ю. Сети мобильной связи. Частотно-территориальное планирование: учеб. пособие для вузов / В. Ю. Бабков, М. А. Вознюк, П. А. Михайлов. – 3-е изд. – М.: Горячая линия – Телеком, 2014. – 222 с.  2. Технологии мобильной связи: услуги и сервисы / А. Г. Бельтов [и др.]. – М.: Инфра-М, 2015. – 206 с.  3. Берлин, А. Н. Цифровые сотовые системы связи / А. Н. Берлин. – М.: Эко-Трендз, 2007. – 296 с.  4. Веселовский, К. Системы подвижной радиосвязи / К. Веселовский; под ред. А. И. Ледовского. – М.: Горячая линия – Телеком, 2006. – 536 с.  5. Волков, Л. Н. Системы цифровой радиосвязи: базовые методы и характеристики: учеб. пособие для вузов / Л. Н. Волков,М. С. Немировский, Ю. С. Шинаков. – М.: Эко-Трендз, 2005. – 392 с. |

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| **Module name** | **MRET-М19 "Pedagogical practice"** |
| **Semester(s) in which the module is taught** | 3 |
| **Person responsible for the module** | supervisor of master's thesis, scientific advisor (Russian)  supervisor of master's thesis, scientific advisor (Kazakh)  (English) |
| **Language** | Kazakh/Russian/English |
| **Relation to curriculum** | **Compulsory / elective / specialisation**  Compulsory |
| **Teaching methods** |  |
| **Working hours (incl. class hours, self-study hours)** | **Total working hours:** 120 hours  **Class hours:**  Practice -120 hours |
| **Credits** | 4 |
| **Required and recommended prerequisites for joining the module** | Pedagogy of Higher Education, Foreign Language (Professional) |
| **Module objectives/intended learning outcomes** | **MODULE OBJECTIVES:** consolidation and deepening of knowledge on general scientific, cultural, psychological, pedagogical, methodological, and special disciplines, as well as the formation of pedagogical skills and competencies on theoretical knowledge basis.  **LEARNING OUTCOMES:**  **Demonstrate** the ability to independently acquire and use in practice new knowledge and skills, including in new areas of knowledge not directly related to the field of activity, to expand and deepen their scientific outlook, including the use of modern information technology, the ability to analyze, synthesize and critically summarize information.  **Use** in-depth theoretical and practical knowledge that is at the cutting edge of science and technology in the professional field.  **Demonstrate** readiness for pedagogical activities in professional training. |
| **Content** | Study of the state educational standard and modular (MUP) curriculum on "RET" DP; educational-methodical literature, hardware and software of laboratory workshops on one selected discipline of the curriculum; organizational forms and methods of training in a higher educational institution.  Conducting practical and laboratory classes with students on the recommended topics of academic disciplines; conducting test lectures in classrooms under teacher’s control. |
| **Current control** | Control of the internship tasks execution according to the Internship Diary by the internship supervisor from the university. |
| **Final control** | Defense of the practice report in front of the commission |
| **Study and examination requirements** | **Requirements for successful module passing:**  Study of normative documents; laboratory equipment of the laboratories of the TCIT department; presentation preparation for the practice report defense |
| **References** | 1. Normative documents on higher and postgraduate education. 2. Хан С.Г. Методические указания по организации и проведению профессиональной практики по группе образовательных программ послевузовского образования «Автоматизация и управление» для магистрантов ОП «Автоматизация и управление». – Алматы: АУЭС, 2020. – с. 20. |