**KAZAKH NATIONAL UNIVERSITY NAMED AFTER AL-FARABI**

**Physics and Technology Faculty**

**Department of Solid State and Nonlinear Physics**

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|  | **AFFIRM**  **Dean of the faculty**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **А.Е. Davletov**  **"\_\_\_\_\_\_"\_\_\_\_\_\_\_\_ 2022y.** |

**EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE**

**SSRTS 4216 - "Satellite and radio relay transmission system"**

Specialty " 6B06201-radio engineering, electronics and telecommunications»

Educational program in basic disciplines " radio engineering»

Course – 4

Semester –7

Amount of the Credits – 3

**Almaty 2022y.**

The educational and methodological complex of the discipline was compiled byBaideldinovU.S.., Ph.D.

Based on the working curriculum in the specialty "6B06201-Radio Engineering, Electronics and Telecommunications"

Considered and recommended at a meeting of the department \_\_\_\_\_\_\_\_\_\_\_\_\_\_

« 27 » june 2022 г., protocol №

Head department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ imbraimov M.K.

(signature)

Recommended by the methodological bureau of the faculty

« 01 » 07 2022 г., protocol №11

Chairman of the methodological bureau of the faculty \_\_\_\_\_\_\_\_\_\_\_\_\_\_Gabdullina A.D.

(signature)

**SYLLABUS**

**Fall semester 2022-2023 year**

**under the educational program "Radio Engineering, Electronics and Telecommunications"**

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| Discipline’scode | Discipline’s title  **"** Satellite and radio relay transmission system **"** | Independent work of students (IWS) | No. of hours per week | | | Numberofcredits | Independent work of student with teacher (IWST) |
| Lectures (L) | Practicaltraining (PT) | Laboratory (Lab) |
| SRRTS | "Satellite and radio relay transmission system" | - | 15 | 15 | - | 3 | - |

**Academic information about the course**

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| --- | --- | --- | --- | --- |
| Form of education | Type of course | Types of lectures | Types of practical training | Form of final control |
| Online | Theoretical | Problematic, analytic | Problem solving, situational tasks | Writing exam |
| Lecturer | BaideldinovUakaskanSeitkazinovich | | | According to schedule |
| e-mail | **\*\*Baideldinov57@mail.ru** | | |
| Телефоны | 8777 377 86 57; 8707 703 86 57 | | |

**Academic course presentation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Purpose of the course** | | **As a result of studying the discipline the student will be able to:** | | **LO achievement indicators**  (for each LO at least 2 indicators) | |
| to form in students a comprehensive understanding of the fundamental principles underlying radio engineering systems for transmitting information and receiving information. | | **LO 1. Explain the main forms of information exchange in systems, the physical principles of operation and the main technical characteristics of radio transmitting and receiving systems of satellite and radio relay transmission systems;** | | **ID 1.1 Understand the main forms of information exchange in systems.**  **ID 1.2 Understand the physical principles of operation.**  **ID 1.3 Understand the basic technical characteristics of radio transmitting and receiving information transmission systems.** | |
| **RO2. Carry out modeling, theoretical and experimental research of newly developed units and devices using modern methods of analysis and synthesis;** | | **ID 2.1 Carry out theoretical modeling of RTSPI with the concept.**  **ID 2.2 Be able to conduct a theoretical study of the propagation of radio waves.**  **ID 2.3 Understand how to use modern models for organizing the exchange of information in various frequency bands.** | |
| **RO 3 To be able to compare current and future trends in the development of networks and systems, satellite and radio relay transmission systems;** | | **ID 3.1 Conduct a theoretical study on the organization of signal generation in radio transmitting devices.**  **ID 3.2 Apply the possibilities of radio wave propagation in the VHF band to improve the RTM.**  **ID 3.3 Find correct solutions for fading conditions in different frequency bands.** | |
| **RO 4 Based on the RRT theory, know the physical principles of the operation of antenna-feeder devices, the basics of trajectory measurements;** | | **ID 4.1 To be able to optimize, in comparison, modern and promising directions in the development of radio engineering systems.**  **ID 4.2 Know the physical principles of the formation of an information radio signal.**  **ID 4.3 To know the physical principles of operation of antenna-feeder devices, the basics of trajectory measurements.**  **ID 4.4 Know the principles of operation of radio receivers.** | |
| **RO 5 Solve problems on the use of antenna devices in various satellite and radio relay transmission systems.** | | **ID 5.1 To have an idea about the ways and methods of transmitting information and RRT in all frequency ranges.**  **ID 5.2 Understand the procedure for clustering in mobile communication systems and dealing with EMC issues in other radio frequency bands.** | |
| Prerequisites | | The study of the discipline "Radio-relay and satellite communication systems" is based on knowledge of the fundamental laws of physics and higher mathematics, courses RPDU, RPU, AFU, TPEM in the theory of transmission of electromagnetic waves. | | | |
| Postrequisites | | Further study of modern systems for transmitting and receiving information as; Radar location, satellite and stone communication system, satellite earth sounding system and global navigation system. | | | |
| Literature and resources | | 1. N.N. Fomin et al. Radio receivers. - M.: Hot line -Telecom, 2005. - 472 p.: ill.  2. Shahgildyan. Radio transmitting devices (Basic methods and characteristics). - M.: Ecotrends, 2005. - 392 p.: ill. 3. Kartashevsky V.G. Communication networks.: Moscow, 2001. - 311 p.: ill. 4. Radio engineering systems: a textbook for students. universities / [ed. Yu.M.  Kazarinov, Yu. A. Kolomensky, V.M. Kutuzov and others]; ed. Yu.M.  Kazarinov. - M.: Academy, 2008. - 592 p.  5. Belov, V. M. Information theory: a course of lectures: a textbook for universities. - M. : Hotline-Telecom, 2012. - 143 p.  6. Nikolsky B.A. Fundamentals of radio engineering systems. – Samara, SSAU, 2013. -469 p.  Internet resources:  1.Electronic Journal "Radio Engineering"  Available online: Additional educational material on the discipline "Radio Engineering Information Transmission Systems", guidelines for practical and laboratory classes, assignments for performing IWS will be available on your page on the website univer.kaznu.kz. in the UMKD section. | | | |
| **Academic Policy of the Course in the Context of University Moral and Ethical Values** | | **Rules of academic conduct:**  **All students are required to register for the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the schedule for studying the discipline.**  **ATTENTION! Failure to meet deadlines results in loss of points! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the training course, as well as in the MOOC.**  **Academic values:**  **- Practical/laboratory exercises, SIW should be independent, creative.**  **- Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.**  **- Students with disabilities can receive consulting assistance at the e-address \*\*\*\*\*\*\*@gmail.com. Baideldinov57@mail.ru (+77773778657)** | |
| **Assessment and assessment policy** | | **Criteria-based assessment: assessment of learning outcomes in relation to descriptors (checking the formation of competencies at midterm control and exams).**  **Summative assessment: assessment of the activity of work in the audience (at the webinar); evaluation of the completed task.** | |

**CALENDAR (schedule) OF THE IMPLEMENTATION OF THE CONTENT OF THE TRAINING COURSE**

Contractions

L - lecture; PL - practical lesson; IWS - independent work of the student; ISWT - independent work of a student under the guidance of a teacher; CW - control work; FC - frontier control; QS - questions for self-examination; TK - typical tasks; IT - individual tasks

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| --- | --- | --- | --- | --- | --- | --- |
| Неделя | Название темы | | | | Кол-во часов | Максимальный балл |
|  | |
| 1 | Lecture 1. Features of the propagation of radio waves and | | | | 1 | 2 |
| 1 | classification of the radio communication system. | | | | 2 | 4 |
| 1 | Lab 1.1 Examine job description | | | | 2 | 2 |
|  |
| 2 | Lecture 2. General principles of RRL construction. | | | | 1 | 2 |
| 2 | Seminar.2. .Physical phenomena leading to signal attenuation. | | | | 2 | 4 |
| 2 | Lab 1.1 Examine job description | | | |  |  |
| 3 | Lek.3. Principles of construction of equipment for radio relay stations. | | | | 1 | 2 |
| 3 | Seminar.3.Principles of information exchange in space radio links of communication systems based on multiple access. | | | | 2 | 4 |
| 3 | Laboratory work 1.1-2 Study and study of ВОЛС | | | | 2 | 2 |
|  |
| 4 | Lek.4. RRL design. Determination of the heights of antenna supports. | | | | 1 | 2 |
| 4 | Seminar.4. Choice of multiple access, multiplexing and modulation depending on the network architecture. | | | | 2 | 4 |
| 4 | Laboratory work 1.1-3 Study of the physical composition and equipment | | | | 2 | 2 |
| 4 | Self-training of a student with a teacher | | | |  | 8 |
|  |
| 5 | Lek.5. Calculation of communication stability for digital RRL. | | | | 1 | 2 |
| 5 | Seminar.5. Subscriber stations VSAT | | | | 2 | 4 |
| 5 | Lab 1.1-4 Practical measurement of parameters | | | | 2 | 2 |
|  |
| 6 | Lecture 6. Hierarchies of digital signals. Methods of modulation, coding and signal processing in digital RRL (CRRL). | | | | 1 | 2 |
| 6 | Seminar 6. Solution of the problem of reliability of the satellite communication system and its importance for modern technology. | | | | 2 | 4 |
| 6 | Laboratory work 2.1 Studying the operation of ВОЛС | | | | 2 | 2 |
|  |
| 7 | Lecture 7. Satellite communication systems; basic principles of construction; orbit parameters; types of orbits. | | | | 1 | 2 |
| 7 | Semina 7. Inter-satellite links. Flexibility of placement on the orbital arc. Connections in orbit. | | | | 2 | 4 |
| 7 | Lab 2.1-1 Using metrological tools in FOCL | | | | 2 | 2 |
| 7 | Frontier control No. 1 | | | |  | 70+30 |
|  |
| 8 | Lecture 8. Main characteristics, structure of space stations. | | | | 1 | 2 |
| 8 | Seminar 8. Analogue and digital transmission. | | | | 2 | 4 |
| 8 | Lab 2.1-1-2 Examine the description of connectors and their operation | | | | 2 | 2 |
| 8 | Self-training of a student with a teacher | | | |  | 8 |
|  |
| 9 | Lecture 9. Ground segment. Structural diagram of the earth station. VSAT systems. | | | | 1 | 2 |
| 9 | Seminar 9. Equipment for sealing digital circuits with other communication systems. | | | | 2 | 4 |
| 9 | Laboratory work 2.1.1-3 Studying the order of information transmission in ВОЛС | | | | 2 | 2 |
|  |
| 10 | Lecture 10. Energy calculation of a satellite communication line. | | | | 1 | 2 |
| 10 | Seminar 10. Intervals between stations. Long-distance communications on the microwave. | | | | 2 | 4 |
| 10 | Laboratory work 2.1.1-4 The procedure for converting information into ВОЛС | | | | 2 | 2 |
|  |
|  |
| 11 | Lecture 11. Electromagnetic compatibility. | | | | 1 | 2 |
| 11 | Seminar 11. Features of frequency and time division multiplexing in radio relay communication. | | | | 2 | 4 |
| 11 | Lab 3.1 Learn how СИД work | | | | 2 | 2 |
|  |
| 12 | Lecture 12. EMC of geostationary satellite communication networks sharing the same frequency bands. | | | | 1 | 2 |
| 12 | Seminar 12. Pulse-phase and pulse-code modulation. | | | | 2 | 4 |
| 12 | Laboratory work 3.1-1 Studying the description of the work of diodes of semiconductor elements in signal transmission | | | | 2 | 2 |
| 12 | Self-training of a student with a teacher | | | |  | 8 |
|  |
| 13 | Lecture 13. Communication satellite of the Republic of Kazakhstan "KazSat". | | | | 1 | 1 |
| 13 | Seminar13. Intermediate stations for lines condensed in time and frequency. | | | | 2 | 2 |
| 13 | Lab 3.1-2 Examine the description of the operation of the ВОЛС transmitter | | | | 2 | 2 |
|  |
| 14 | Lecture 14. Technical appearance and main characteristics of "KazSat-103". | | | | 1 | 2 |
| 14 | Seminar14. Radio transmitters and radio receivers. | | | | 2 | 4 |
| 14 | Lab 3.1-3 Examine the description of the operation of the ВОЛС receiver | | | | 2 | 2 |
|  |
| 15 | Lecture 15. Losses due to refraction and inaccuracies in antenna pointing. | | | | 1 | 2 |
| 15 | Seminar 15. The length of radio relay lines and the reliability of their operation. miniaturization problem. | | | | 2 | 4 |
| 15 | Laboratory work 3.1-4 Studying the description of the operation of the entire ВОЛС complex | | | | 2 | 2 |
| 15 | Self-training of a student with a teacher | | | |  | 6 |
|  |
|  | **Рубежный контроль №2** | | | |  | 70+30 |
|  | **РК 2** | | | |  | 100 |

**Remarks**

**- The overall score for boundary control is 70 + 30, five weeks of 14 points each, of which 6 points for the lecturer (2 points for attending a lecture and 4 points for the DEADLINE for passing VS-questions of self-control processing Lectures with brief conclusions and send via Microsoft Teams) and 8 - six points from the teacher conducting the seminar at the end of the last seminar before the boundary control strictly on time to give grades so that there is no misunderstanding and embarrassment.**

**- 30 points of the Republic of Kazakhstan and that in the amount of 100 points.**

**- Course materials (L, VS, TK, IZ, etc.) see the link (see Literature and resources, p. 6).**

**- After each deadline, tasks for the next week are opened.**

**- Assignments for the CR teacher issues at the beginning of the webinar.**

Teacher\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Baideldinov U.S.

Head of the department\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_М.К.Ibraimov

Dean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Davletov A.E.