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

**Physics and Technology Faculty**

**Department of Solid State and Nonlinear Physics**

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

**EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE**

**VOLS 4216** **- "Modern fiber optic communication systems"**

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 byBaideldinov U.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 \_\_\_\_\_\_\_\_\_\_\_\_\_\_

«\_\_\_ » june 2022 г., protocol №

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

(signature)

Recommended by the methodological bureau of the faculty

«\_\_\_» \_\_\_\_\_\_\_\_\_\_ 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"**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Discipline’scode | Discipline’s title  **"** Modern radio-electronic communication systems **"** | Independent work of students (IWS) | No. of hours per week | | | Numberofcredits | Independent work of student with teacher (IWST) |
| Lectures (L) | Practicaltraining (PT) | Laboratory (Lab) |
| SRSS5302 | "fiber optic communication systems" | - | 15 | - | - | 3 | - |

**Academic information about the course**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 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 radio electronics;** | | **AI 2.1 Carry out theoretical modeling of RTSPI with the concept.**  **AI 2.2 Be able to conduct a theoretical study of the propagation of radio waves.**  **AI 2.3 Understand how to use modern models for organizing the exchange of information in various frequency bands.** | |
| **LO 2. Carry out modeling, theoretical and experimental research of newly developed units and devices using modern methods of analysis and synthesis;** | | **AI 3.1 Conduct a theoretical study on the organization of signal generation in radio transmitting devices.**  **AI 3.2 Apply the possibilities of radio wave propagation in the VHF band to improve the RTM.**  **AI 3.3 Find correct solutions for fading conditions in different frequency bands.** | |
| **LO 3 To be able to compare modern and perspective directions of development of networks and systems, radio engineering systems;** | | **AI 4.1 To be able to optimize, in comparison, modern and promising directions in the development of radio engineering systems.**  **AI 4.2 Know the physical principles of the formation of an information radio signal.**  **AI 4.3 To know the physical principles of operation of antenna-feeder devices, the basics of trajectory measurements.**  **AI 4.4 Know the principles of operation of radio receivers.** | |
| **LO 4 Based on the RRT theory, know the physical principles of the operation of antenna-feeder devices, the basics of trajectory measurements;** | | **AI 5.1 To have an idea about the ways and methods of transmitting information and RRT in all frequency ranges.**  **AI 5.2 Understand the procedure for clustering in mobile communication systems and dealing with EMC issues in other radio frequency bands.** | |
| **LO 5 Solve problems on the use of antenna devices in various electronic devices.** | | **AI 2.1 Carry out theoretical modeling of RTSPI with the concept.**  **AI 2.2 Be able to conduct a theoretical study of the propagation of radio waves.**  **AI 2.3 Understand how to use modern models for organizing the exchange of information in various 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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| week | | topic | | | | Amount of hours | Maximum score |
|  | | | |
| 1 | | 1 lecture. Introduction. Classification and principles of construction of optical transmission systems. (Uch.pos-1, s 5) | | | | 1 | 2 |
| 1 | | PL. The principle of building OSS | | | | 2 | 4 |
| 1 | | Lab. Study of FOT materials | | | | 2 | 2 |
|  |
| 2 | | 2 lecture. Sources of optical radiation. (Uch.pos-1, s 8) | | | | 1 | 2 |
| 2 | | PL**.** Elements of optics and their work | | | | 2 | 4 |
| 2 | | Lab. The physical structure of the FOT | | | |  |  |
| 3 | | 3 lecture. Radiation source modulation | | | | 1 | 2 |
| 3 | | PL. Consideration of the physical principles of modulation | | | | 2 | 4 |
| 3 | | Lab. Study of the composite structure of FOTS | | | | 2 | 2 |
| 3 | | IWST 1: Analysis of the structure given by the teacher FOCL. | | | | 1 | 6 |
|  |
| 4 | | 4 lecture. Receiving optical modules. | | | | 1 | 2 |
| 4 | | PL. Composition and physical principle of optical reception modules | | | | 2 | 4 |
| 4 | | Lab. Studying the principles of operation of the receiving optical module | | | | 2 | 2 |
|  |
| 5 | | 5 lectures. Optical amplifiers and regenerators. | | | | 1 | 2 |
| 5 | | PL. Composition and structure of optical modules and regenerators | | | | 2 | 4 |
| 5 | | Lab. Study of optical modules and regenerators | | | | 2 | 2 |
| 5 | | IWST 2: Selection of the communication route set by the teacher FOCL | | | | 1 | 4 |
|  |
| 6 | | 6 lecture. FOCL sealing methods. | | | | 1 | 2 |
| 6 | | PL. Investigation of radiophysical methods of compaction in comparison with FOCL | | | | 2 | 4 |
| 6 | | Lab. Research and consideration of sealing issues in FOCL | | | | 2 | 2 |
|  |
| 7 | | 7 lecture. FOTS Line Codes | | | | 1 | 2 |
| 7 | | PL. Research of questions of codes in FOCL | | | | 2 | 4 |
| 7 | | Lab. Practical study of codes in FOCL. | | | | 2 | 2 |
| 7 | | IWST 3 Development of a linear path of analog MTS | | | | 1 | 4 |
| 7 | | Frontier control No. 1 | | | |  | 70+30 |
|  |
| 8 | | 8 lecture. Modern technologies and equipment of the optical communication system | | | | 1 | 2 |
| 8 | | PL. Research and comparison of modern technologies in FOCL | | | | 2 | 4 |
| 8 | | Lab. Practical and physico-mathematical comparison of modern FOCL technologies | | | | 2 | 2 |
|  |
| 9 | | 9 lecture. Synchronous digital networks based on SDH technology. | | | | 1 | 2 |
| 9 | | PL. Physical consideration of synchronous digital networks based on SDH technology. | | | | 2 | 4 |
| 9 | | Lab. Solving issues of synchronization in FOCL | | | | 2 | 2 |
| 9 | | IWST 4: Development of a teacher-specified SPTS. | | | | 1 | 4 |
|  |
| 10 | | 10 lecture. Hardware implementation of functional blocks of SDH networks | | | | 1 | 2 |
| 10 | | PL. Functional blocks of SDH networks | | | | 2 | 4 |
| 10 | | Lab. Practical and theoretical comparison of SDH and PDH functional blocks | | | | 2 | 2 |
|  |
|  |
| 11 | | 11- Spectral Densification | | | | 1 | 2 |
| 11 | | PL. Spectrum Considerations for FOCL | | | | 1 | 2 |
| 11 | | Lab. Practical consideration of the FOCL spectrum in laboratory facilities. | | | |  |  |
| \\ |
| 12 | | 12 lecture. Fundamentals of WDM technology. | | | | 1 | 2 |
| 12 | | PL. WDM Technology Research | | | | 2 | 4 |
| 12 | | Lab. Practical study of the possibility of FOCL | | | | 2 | 2 |
| \ |
| 13 | | 13 lecture. Implementation schemes for WDM multiplexers. | | | | 1 | 2 |
| 13 | | PZ. Multiplexers and their functions | | | | 2 | 4 |
| 13 | | Lab. Practical operation of multiplexers | | | | 2 | 2 |
| 13 | | TSIS 6: Issues of practical perfection of FOCL | | | | 1 | 8 |
|  |
| 14 | | 14 lecture. Passive optical networks | | | | 1 | 2 |
| 14 | | PL. Solving issues of passive optical networks. | | | | 2 | 4 |
| 14 | | Lab. Research and improvement of issues of passive optical networks | | | | 2 | 2 |
|  |
| 15 | | 15 lecture. The principle of operation of passive optical networks | | | | 1 | 2 |
| 15 | | PL. Research and calculation of optical networks. | | | | 2 | 4 |
| 15 | | Lab. Practical comparison of optical networks. | | | | 2 | 2 |
| 15 | | IWST 7: Operability Analysis of FOCL Networks | | | | 1 | 4 |
|  |
|  | | Frontier control No. 2 | | | |  | 70+30 |
|  | | FC 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.