**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**  **"\_\_\_\_\_\_"\_\_\_\_\_\_\_\_ 2020y.** |

**EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE**

**SRSS5302- "Modern radio-electronic communication systems»**

Specialty " 7М06201-radio engineering, electronics and telecommunications»

Educational program in basic disciplines " radio engineering»

Course – 1

Semester –1

Amount of the Credits – 3

**Almaty 2020y.**

Educational-methodical complex of the discipline was made by сandidate of physical and mathematical sciences. Baideldinov U.S.  
  
  
Based on the working curriculum on the specialty:

7М06201– «Radioengineering, Electronics and Telecommunications»

Considered and recommended at the meeting of the department

from «\_27\_\_ » \_\_\_\_06\_\_\_\_\_\_\_ 20 20, protocol № 10

Head chair \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ М.К.Ibraimov

(sign)

Recommended by the methodical bureau of the faculty

from «\_01\_\_ » \_\_\_\_07\_\_\_\_\_\_\_ 2020, protocol № 11

Chairperson  
method department of the faculty\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Gabdullina А.Т.

(sign)

**Syllabus**

**Fall semester2020 school year**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |  | - | 15 | 15 | | - | | 3 | - |
| Academiccourseinformation | | | | | | | | | |
| Formofeducation | Typeofcourse | Typesoflectures | | | Typesofpracticaltraining | | Numberof IWS | | Formoffinalcontrol |
| Online | Theoretical | Analytical | | | Solving problems | | 6 | | exam |
| Lecturer | BaideldinovUakaskanSeitkazinovich | | | | | |  | | |
| e-mail | **\*\*Baideldinov57@mail.ru** | | | | | |
| Telephonenumber | 8777 377 86 57; 8707 703 86 57 | | | | | |

|  |  |
| --- | --- |
| Academic presentation of the course | **Type of training course:**  The course is designed to learn the basics of radio information transmission systems. And also to acquaint the student with the electronic devices necessary for implementation of radio engineering systems of transmissions of information of radio transmitters and radio receivers. Learn the principles of data transmission and data reception.  **Purpose of the course**:to form a comprehensive understanding of the fundamental principles underlying radio systems of information transmission and reception.  **As a result of studying the discipline the student will be able to:**  1. to analyze the main forms of information exchange in systems, physical principles of operation and the main technical characteristics of radio transmitting and radio receiving systems of radio electronics;  2. to carry out modeling, theoretical and experimental research of newly developed units and devices, using modern methods of analysis and synthesis;  3.to compare modern and perspective directions of development of telecommunication and information networks and systems, radio engineering systems;  4. know the physical principles of antenna-feeder devices, the basics of trajectory measurements;  5. have an idea about the methods and methods of information transmission and RRV, optical signal processing methods;  6. apply antenna devices in various electronic devices. |
| Prerequisites | The study of "Receiving / transmitting radio and communication systems" is based on the knowledge of the fundamental laws of physics and mathematics courses, Fundamentals of radio electronics and telecommunications-1 and Fundamentals of radio electronics and telecommunications-2, the theory of transmission of electromagnetic waves . |
| Prerequisites | Further study of modern systems of transmission and reception of information such as; radar, satellite communication system, satellite earth sensing system and global navigation system. |
| Literature and resources | **Literature**  1. N. N. Fomin et al. radio Receivers. - Moscow: Hotline-Telecom, 2005. - 472 p.: Il.  2.Shakhgildyan. Radio transmitting devices (Basic methods and characteristics). - M.: Ecotrends,2005. - 392 p.: Il. 3.Kartashevsky V. G.. Communication network.: Mosca, 2001. – 311 p.: Il. 4. Radio engineering systems: a textbook for students. universities / [ed. YM.  Kazarinov, Yu. A. Kolomensky, V. M. Kutuzov et al.]; under the editorship of Yu. M.  Kazarinova. - Moscow: Akademiya, 2008. - 592c.  5. Belov, V. M. information Theory: a course of lectures: a textbook for universities. - Moscow: Hotline-Telecom, 2012. - 143 p.  6. Nikolsky B. A. Fundamentals of radio systems. - Samara, SGAU, 2013. -469 PP.  **Internet resources:**  1.Electronic Journal " Radio Engineering»  **Available online:** Additional training material on the discipline "radio-Technical information transmission systems", guidelines for practical and laboratory classes, tasks for the implementation of SRS will be available on your page on the website univer.kaznu.kz. in the umcd section. |
| Academic policy of the course in the context of university moral and ethical values | **Rules of academic conduct:**  Mandatory attendance at classes, inadmissibility of lateness. Absence and lateness to classes without prior warning of the teacher are estimated at 0 points.  Mandatory compliance with deadlines and delivery of tasks (SRS, boundary, control, project, etc.), projects, exams. In case of violation of deadlines, the completed task is evaluated taking into account the deduction of penalty points.  **Academicvalue:**  Academic honesty and integrity: independence of all tasks; inadmissibility of plagiarism, forgery, use of Cribs, cheating at all stages of knowledge control, cheating of the teacher and disrespectful attitude to him. (KazNU student honor code). Students with disabilities can receive counseling by e-mail or telephone. |
| Evaluation and attestation policy | **Criteria-basedevaluation:** evaluation of learning outcomes in relation to descriptors (checking the formation of competencies at the boundary control and exams). Homework - 10%, SRS-50%, Exams-40%, TOTAL-100%  **Summativeevaluation:**assessment of the presence and activity of the work in the audience; assessment of the completed task, SRS (project )  The final score will be calculated according to the formula  Below are the minimum percentages:  95% - 100%: A 90% - 94%: A-  85% - 89%: B+ 80% - 84%: B 75% - 79%: B-  70% - 74%: C+ 65% - 69%: C 60% - 64%: C-  55% - 59%: D+ 50% - 54%: D-0% -49%: F |

**Calendar for the implementation of the content of the training course**

L - lecture; PT - practical lesson; SRSP - independent work of a student under the guidance of a teacher BC – boundary control; QS - questions for self-examination; TT - typical tasks; IT - individual tasks

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| weeks | Topicname | LO | ID | amountofhours | Maximumscore | FormofKnowledgeAssessment | The  Form of the lesson  / platform |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Module**ІRadio transmitting device and radio wave propagation** | | | | | | | |
| 1 | **L.1** Introduction.  Content: content and objectives of the discipline. Its features and connection with other disciplines. The importance of the development of radio transmitters and radio receivers in scientific and technological progress. A brief historical overview of the development of radio devices. Purpose and classification of radio transmitting devices. Generator with external excitation. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 1 | **PT 1**Structure and General characteristics of the radio transmitting device. Draw yourself with an explanation of the structures and ranges of the generator with external excitation. | LО 1 | ID 1.1. | 1 | 6 | Analysis | Webinar  in MS Teams |
| 1 | **LW1.**the study of the LC auto generator |  |  |  |  |  |  |
| 1 | **SRSP 1.** Analysis of the features of the main modes of operation of generator |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS1, TT1** | | | | | | |
| 2 | **L.2**Modes of operation of the generator oscillations of the first and second kind. Harmonic analysis of output current pulses Generator's. The power supply circuit of the generator. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 2 | **PT 2**Disassemble: Features of the main modes of operation generator. The regime of linear amplification.The amplification modes with a cutoff the output current. | LО 1 | ID 1.1. | 1 | 6 | Analysis | Webinar  in MS Teams |
| 2 | **LW2**the study of the RC auto generator |  |  |  |  |  |  |
| 2 | **SRSP 2**. Analysis of linear mode gain. |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS2, TT2** | | | | | | |
| 3 | **L.3**Modes of operation of the generator on tension. Addition of power generators. Transmitter output stages | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 3 | **PT 3**To disassemble: Load characteristics of HBV.The dynamic characteristics of HBV. Undervoltage, critical and overvoltage modes. | LО 1 | ID 1.1. | 1 | 6 |  | Webinar  in MS Teams |
| 3 | **LW3**self-Oscillating LC circuit under external influence | LО 1 | ID 1.1. |  |  |  | Webinar  in MS Teams |
| 3 | **SRSP 3.** Analysis of amplification modes with a cutoff the output current | LО 2 | ID 2.1. |  |  | Logictask |  |
|  | **Saturday 23:00 – DEADLINE for QS3, TT3, IT1** | | | | | | |
| 4 | **L.4**Frequency multipliers. Self-oscillators. Modes of self-excitation of oscillators | LО 3 | ID 3.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 4 | **PT 4**Disassemble: the Purpose of frequency multipliers.The principle of obtaining the frequency multiplication mode. Schematic diagrams of transistor frequency multipliers. Determining the selection of the cutoff angle at different multiplication factors. Frequency multiplication invaricap. | LО 1 | ID 1.1. | 1 | 6 |  | Webinar  in MS Teams |
| 4 | **LW4**single-band modulation study |  |  |  |  |  |  |
| 4 | **SRSP 4.** Analysis of energy indicators of the main modes of operation of gwv |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS4, TT4, IT2** | | | | | | |
| 5 | **L.5**Causes of frequency instability and parametric methods of its stabilization. Quartzfrequencystabilization. Schemesofquartzoscillators. | LО 4 | ID 4.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 5 | **PT 5**Disassemble: Causes of instability of the generated frequency. Parametricmethodsoffrequencystabilization.Disadvantages of parametric frequency stabilization. Quartzanditsproperties. | LО 1 | ID 1.1. | 1 | 6 |  | Webinar  in MS Teams |
| 5 | **LW5** a Study of the frequency synthesizer | LО 1 | ID 1.1. |  |  |  | Webinar  in MS Teams |
| 5 | **SRSP 5.** Features of gwv power supply schemes depending on the operating frequency | LО 4 | ID 4.1. |  |  | Logictask |  |
|  | **Saturday 23:00 – DEADLINE for QS5, TT5, IT2** | | | | | | |
| 5 | **BC 1** | LО 1 | ID 1.1. |  | 60+40 |  |  |
| **ModuleІІRadio receivers and EMC issues** | | | | | | | |
| 6 | **L.6**Purpose, structure and technical characteristics of radio receivers. Theinputcircuitoftheradio | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 6 | **PT 6**Structure and principle of operation of radio receivers | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 6 | **LW6** Study of a frequency-modulated oscillator |  |  |  |  |  |  |
| 6 | **SRSP 6.** Block diagrams and indicators of the radio path of the receiver |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS6, TT6** | | | | | | |
| 7 | **L.7**Amplifiers of radio signals. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 7 | **PT 7**Schemes of resonance amplifiers on non-reciprocal elements; | LО 5 | ID 5.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 7 | **LW7** Amplitude Detector Study |  |  |  |  |  |  |
| 7 | **SRSP 7.** Methods of increasing the stability of resonant amplifiers;Resonant amplifier in the frequency range; |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS7, TT7** | | | | | | |
| 8 | **L.8**Frequency converters and parametric amplifiers. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 8 | **PT 8**Analysis of the generalized equivalent circuit of the resonant amplifier | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 8 | **LW8** Frequency Conversion Study | LО 1 | ID 1.1. |  |  |  | Webinar  in MS Teams |
| 8 | **SRSP 8** Diode detection of radio pulses. | LО 1 | ID 1.1. |  |  | Logictask |  |
|  | **Saturday 23:00 – DEADLINE for QS8, TT8, IT3** | | | | | | |
| 9 | **L.9**Detectors of radio signals. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 9 | **PT 9**Diode detection OF am oscillations. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 9 | **LW9** Study of receiver AGC systems |  |  |  |  |  |  |
| 9 | **SRSP 9** Digital amplitude limiters |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS9, TT9, IT4** | | | | | | |
| 10 | **L.10**Heterodyne tract, adjustment and indication in the radio receiving devices. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 10 | **PT 10**Varieties of amplitude detectors. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 10 | **LW10** Studying the principle of operation of a superheterodyne receiver of AM signals | LО 1 | ID 1.1. |  |  |  | Webinar  in MS Teams |
| 10 | **SRSP 10** Peak detector | LО 1 | ID 1.1. |  |  | Problemtask |  |
|  | **Saturday 23:00 – DEADLINE for QS10, TT10** | | | | | | |
| 10 | **BC2** | LО 1 | ID 1.1. |  | 60+ 40 |  |  |
| **ModuleІІІ** | | | | | | | |
| 11 | **L.11**Radio receivers with digital signal processing. | LО 1 | ID 1.1. | 1 | 2 |  |  |
| 11 | **PT 11**Characteristics of digital signal processing; | LО 1 | ID 1.1. | 1 | 8 | Analysis | Video lecture  in MS Teams |
| 11 | **LW11** HRO study |  |  |  |  |  |  |
| 11 | **SRSP 11.** Receiver on matched filters and examples of its engineering implementation. |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS11, TT11** | | | | | | |
| 12 | **L.12** Electromagnetic interference in radio receivers. | LО 1 | ID 1.1. | 1 | 2 |  | Webinar  in MS Teams |
| 12 | **PT 12**The process of signal conversion in digital processing; | LО 1 | ID 1.1. | 1 | 8 | Analysis | Video lecture  in MS Teams |
| 12 | **LW12** Investigation of frequency detectors | LО 1 | ID 1.1. |  | 5 |  | Webinar  in MS Teams |
| 12 | **SRSP 12.**Digitalgenerators. | LО 1 | ID 1.1. |  | 25 | Problemtask |  |
|  | **Saturday 23:00 – DEADLINE for QS12, TT12** | | | | | | |
| 13 | **L.13**Diversityreception. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 13 | **PT 13**The formation of channels of diversity reception | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 13 | **LW13** Research of a low-level radio transmitter |  |  |  |  |  |  |
| 13 | **SRSP 13.** Methods of combining signals with diversity reception |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS13, TT13, IT5** | | | | | | |
| 14 | **L.14**Cellular network. Trunking networks. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 14 | **PT 14**Planning of mobile communication networks. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 14 | **LW14** The study of mobile radio stations such as "Len-V" |  |  |  |  |  |  |
| 14 | **SRSP 14.** Selection and synthesis of mobile networks |  |  |  |  |  |  |
|  | **Saturday 23:00 – DEADLINE for QS14, TT14, IT6** | | | | | | |
| 15 | **L.15**Radio relay and satellite communication networks. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
|  | **PT 15**Implementation and planning of radio relay networks. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
|  | **LW15** A study of trunked radio stations and comparisons with cellular mobile communications | LО 5 | ID 5.1. |  |  |  | Webinar  in MS Teams |
|  | **SRSP 15.** Integration of all types of radio communication. | LО 1 | ID 1.1. |  |  | Analysis |  |
|  | **Saturday 23:00 – DEADLINE for QS15, TT15** | | | | | | |
|  | **BC3** | LО 1 | ID 1.1. |  | 60+ 40 |  |  |
|  | **Exam** | LО 1 | ID 1.1. |  | 100 |  |  |

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

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

Chairperson method department

of the faculty \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_G. T. Gabdullina