Al-Farabi Kazakh National University

Physics and Technology Faculty

Chair of Solid State Physics and Nonlinear Physics

**Syllabus  
Spring semester 2022-2023 academic year**

Academic course information

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Discipline’s code | Discipline’s title | | Type | No. of hours per week | | | | Number of credits | | ECTS |
| Lect. | Pract. | | Lab. |
| 8B712 | Bases of Radio Engineering and Telecommunications | | BC (basic component) | 2 | 1 | | - | 2 | | 4 |
| Lecturer | | Turlykozhayeva Dana | | | | Office hours | | | Scheduled | |
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| Telephones | | 87472666916 | | | | Auditory | | | 226 | |
| Assistant | | Turlykozhayeva Dana | | | | Office hours | | | Scheduled | |
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| Academic presentation of the course | **Type of course** theoretical, practical, basic.  **The aim of the course** «Bases of Radio Engineering and Telecommunications» consists of study basic principles of generation, transmission, and reception of radio waves, classification the signals and systems used in this field, communication channels as well as the features of propagation of radio waves in space. |
| Prerequisites | "Mathematics-1,2,3", “Physics”, "Theory of Electric Circuits " |
| Post requisites | “Theory of electric communication” |
| Information resources | **Literature:**   1. J.B.Hagen. Radio-Frequency Electronics: Circuits and Applications. Second Edition, Cambridge University Press, 435 p., 2009. 2. V. Vodovozov. Introduction to Electronic Engineering, Ventus Publishing ApS, 2010, 135 p. 3. C.Bowich, C.Ajluni, J.Blyler. RF Circuit Design. Second Edition, Elsevier Inc., 342 p., 2008. 4. Thomas W. Electronic communication systems (Rus). Technosphere, 1360p, 2007. 5. Romanyuk V.A. Basics of radio (Rus), Yurayt, 287p, 2011. 6. Zhanabaev Z.Zh. Tarasov S.B., Almasbekov N.E. Statistical methods of radio physics and electronics. "Kazakh university.",117p, 2002.   **Internet resources:** Additional training material on programming Recessed systems, source codes used for homework and projects will be available on your page on univer.kaznu.kz site. in EMCD section. (Recommended MOOK master courses on the discipline) |
| Academic policy of the course in the context of university moral and ethical values | **Academic Behaviour Rules:** Compulsory attendance in the classroom, the impermissibility of late attendance. Without advance notice of absence and undue tardiness to the teacher is estimated at 0 points.  Submission of assignments (Independent work of students, midterm control, laboratory tasks, projects and etc.) prior to the deadlines. The violation of submission deadlines leads to the deduction of penalty points.  **Academic values:** Academic honesty and integrity: independent performance of assignments; inadmissibility of plagiarism, forgery, cheating at all stages of the knowledge control, and disrespectful attitude towards teachers. (The code of KazNU Student’s honor) |
| Evaluation and attestation policy | **Criteria-based evaluation:** assessment of learning outcomes in correlation with descriptors (verification of competence formation during midterm control and examinations). **Summative evaluation:** evaluation of the presence and activity of the work in the classroom; assessment of the assignment, independent work of students, (project / case study / program / ...). The formula for calculating the final grade.  Minimum estimations are below given in percents: 95% - 100%: А 90% - 94%: А-  85% - 89%: В+ 80% - 84%: В 75% - 79%: В-  70% - 74%: С+ 65% - 69%: С 60% - 64%: С-  55% - 59%: D+ 50% - 54%: D- 25%-49%: FХ 0% -24%: F |

**Calendar (schedule) the implementation of the course content:**

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| --- | --- | --- | --- |
| Week / date | Topic title (lectures, practical classes, Independent work of students) | Number of hours | Maximum score |
| 1 | 2 | 3 | 5 |
| 1 | Lecture 1. Introduction. The purpose and objectives of discipline. The place and role of discipline in the training system of students. A brief history of the development of radio equipment. Classification of radio systems. Block diagram of radio engineering systems.  Practical class 1. Information and messages, signal, communication system.  Lab.1 Phyton. | 2  1  1 | 2  4  6 |
| 2 | Lecture 2. Ranges of frequencies. The fundamental of the electromagnetic field theory. Physical essence of the emission process. Factors that affect radio propagation**.**  Practical class 2. . Range of radio waves and frequencies. Examples of selected radio bands.  Lab.2. Phyton. | 2  1  1 | 2  4  6 |
| 3 | Lecture 3. Elements of Propagation of electromagnetic waves in space. Effects of atmosphere on radio propagation. Atmospheric absorption. Atmospheric ducting. Propagation of radio waves at ground level. Reflection. Multipath phenomena. Shadowing and diffraction. Diffraction loss over terrain features. Longer range signal variation. The effect of buildings.  Practical class 3. Electrodynamics and wave propagation. Key events during propagation of radio waves.  Lab.3. Functional modules of telecommunication stand.  Independent work of student with teacher 1:  Propagation of electromagnetic wave in space. | 2  1  1 | 2  4  6  5 |
|  | Lecture 4. EM wave propagation in ionosphere. Transmission of long, medium, short and Ultrashort waves. Signals, their classification, parameters, the discrete and continuous spectrum of signals. Fourier Transform and Laplace transform.  Practical class 4. The vector and the spectral representation of the signal and the noise. Fourier transformation.  Lab.4. Functional modules of telecommunication stand. | 2  1  1 | 2  4  6 |
|  | Lecture 5. Fundamentals of radio transmitting and receiving devices. Generation of oscillations. Conversion of spectrum of signals. Modulation and demodulation. Signal conversion. Temporal and spectral representation of signals.  Practical class 5. Concept and necessity of modulation. Definition of amplitude modulation.  Lab.5. Amplitude Modulation.  Independent work of student with teacher 2:  Amplitude, frequency and phase modulation. | 2  1  1 | 2  4  6  5 |
|  | Lecture 6. Basics of antenna-feeder technology. Conversion of high-frequency currents and voltages in electromagnetic fields. Elementary emitters. Directional and Omni-directional antennas. The designation of feeder tract. Prospects of development of radio equipment.  Practical class 6. Angle modulation. Frequency and phase modulation.  Lab. 6. Amplitude Modulation. | 2  1  1 | 2  4  6 |
|  | Lecture 7. General characteristics of telecommunication systems. Transmission system line channel, standard transmission channels. Types of transmission lines. Primary and secondary telecommunications network. Communication over long distances. Classification, appointment, conditions of operation, principles of construction of telecommunication systems.  Practical class 7. Fundamentals of the theory of functions of a continuous argument discretization. Nyquist–Shannon sampling theorem.  Lab. 7. Delivery of laboratory work and scoring.  Independent work of student with teacher 3:  Features of the antenna and feeder systems. | 2  1  1 | 3  6  4  5 |
| **1st boundary control** | 1 | 100 |
|  | Lecture 8. Techniques to present and transformation of messages, signals and interference. Message types and their characteristics. How to transform analog messages in digital form (discretization in time, quantization, coding) and back (decoding and interpolation). The concept of information compression. International standards for analog-to-digital conversion. Types of signals and interference of telecommunication systems and their mathematical models.  Practical class 8. A block diagram of a radio link. Antenna-feeder devices.  Lab. 8. Measurement of the radiation pattern of half-wave dipole in the frequency of 2.4 GHz. | 2  1  1 | 2  3  5 |
| **Midterm Examination** | 1 | 100 |
|  | Lecture 9. Multichannel telecommunication systems. Design principles and the structural diagrams of multi-channel systems. Methods of multiplexing and demultiplexing of signals based on the frequency, time and code separation, structural diagrams of telecommunication systems, indicators of quality.  Practical class 9. Interference information coding. BPSK and QPSK modulation.  Lab. 9.Measurement of the radiation pattern of half-wave dipole in the frequency of 2.4 GHz.  Independent work of student with teacher 4:  Conversion of analog signals into digital signals. | 2  1  1 | 2  3  5  5 |
|  | Lecture 10. Digital telecommunication networks types of digital telecommunications systems and their features. Plesiochronous digital hierarchy (RDH). Synchronous digital hierarchy (SDH). The virtues of digital SDH based networks, comparing RDH and SDH networks.  Practical class 10. The data transfer speed in the multi-channel telecommunication systems.  Lab. 10.Pulse Code Modulation (PCM). | 2  1  1 | 2  3  5 |
|  | Lecture 11. Tuned Radio Frequency (TRF) Receiver: Structure and characteristics. Disadvantages of the TRF Receiver design. Superheterodyne Receiver Diagram. Frequency Conversion. Advantages and Disadvantages of AM Superheterodyne Receiver. FM receivers: Structure and characteristics. Demodulation. Differences between AM and FM receivers.  Practical class 11. Methods of separation channels in wireless communication engineering.  Lab.11. Pulse Code Modulation (PCM).  Independent work of student with teacher 5:  Fiber optic communication lines . Issues, trends of development, limiting capabilities. | 2  1  1 | 2  3  5  5 |
|  | Lecture 12. Methods of information distribution in telecommunication networks. Telecommunication networks with routing information (network nodes). Switching channels. Message switching.  Practical class 12. Digital method of data and voice transmission. Plesiochronous Digital Hierarchy (PDH).  Lab. 12. Demodulation of PCM signals. | 2  1  1 | 2  3  5 |
|  | Lecture 13. Packet switching methods. Delays, losses and overload on networks with batch commutation. The concept about managing threads in packet switching networks. Features of packet switching in telecommunications networks.  Practical class 13. Overview SDH (Synchronous Digital Hierarchy) technology.  Lab. 13. Demodulation of PCM signals.  Independent work of student with teacher 6:  Methods of multiplexing and de-multiplexing of signals based on frequency, time and code division. | 2  1  1 | 2  3  5  5 |
|  | Lecture 14. Integration and convergence of digital telecommunication networks. Techno-economic and consumer background transition to universal digital transmission of mess. Digital Network integrated services (ISDN)-access terminals to Rumor was spred through out the transfer bits, works on TDM.  Practical class 14. Integration of telecommunication services. ISDN technology.  Lab. 14. Demodulation of PCM signals. | 2  1  1 | 2  3  5 |
|  | Lecture 15. The principle of construction of intelligent networks. Synchronous (STM) and asynchronous (ATM) transmission modes in digital networks.  Practical class 15. Network switching and multiplexing technology packages. ATM technology.  Lab. 15. Delivery of laboratory work and scoring. | 2  1  1 | 2  9  5 |
| **2st boundary control** | 1 | 100 |
| Examination |  |  |
| Total |  | 100 |

Lecturer Turlykozhayeva D.A.

Head of the department Ibraimov M.K.