**Kazakh National University named after al-Farabi**

**Physics and Technology Faculty**

**Department of Solid State Physics and Nonlinear Physics**

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|  | **APPROVED**  **Dean of the Faculty**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Davletov A.E.**  **"\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ 2020.** |

**EDUCATIONAL-METHODOLOGICAL COMPLEX OF DISCIPLINE**

**8В743 "Modern fiber-optic transmission systems"**

Specialty "5B071900-Radio engineering, electronics and telecommunications"

Educational program in basic disciplines "Telecommunications"

Course - 2

Semester - 3

Number of credits - 3

**Almaty 2020y.**

The educational and methodological complex of the discipline was compiled by U.S.Baydeldinov, Ph.D., Acting Associate Professor

Based on the working curriculum for the specialty "5B071900 - Radio engineering, electronics and telecommunications"

Considered and recommended at the meeting of the Department of Solid State Physics and Nonlinear Physics "27" \_\_\_06\_\_\_ 2020, Minutes No. 10

Head Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ibraimov M.K.

(signature)

Recommended by the methodical bureau of the faculty

"\_27\_\_\_" \_\_\_06\_\_\_\_\_ 20 20, minutes No. 10

Chairperson of the Methodology Bureau of the Faculty \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Gabdullina A.T

(signature)

**SYLLABUS**

**Fall semester 2020-2021 academic years**

**on the educational program “\_\_\_\_\_\_\_\_\_\_\_\_”**

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| **Discipline’scode** | **Discipline’stitle**  "Modern fiber-optic transmission 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)** | |
| 8В743 |  | 1 | 1 | 1 | | 0 | | 3 | 1 |
| **Academiccourseinformation** | | | | | | | | | |
| **Formofeducation** | **Typeofcourse** | **Typesoflectures** | | | **Typesofpracticaltraining** | | **Numberof IWS** | | **Formoffinalcontrol** |
|  |  |  | | |  | | 6 | |  |
| Lecturer | Байдельдинов У.С., Кандидат физико-математических наук, и.о. доцента | | | | | |  | | |
| e-mail | \*\*Baideldinov57@mail.ru | | | | | |
| Telephonenumber | 8 777 377 86 57 | | | | | |

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| **Academic presentation of the course** |

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| **Aimofcourse** | **Expected Learning Outcomes (LO)**  As a result of studying the discipline the undergraduate will be able to: | **Indicators of LO achievement (ID)**  (for each LO at least 2 indicators) |
|  | 1.Know the basics of optical communication, the structure and functioning of the SVOSP, the basic laws of information transfer in infocommunication systems, the main types of signals used in telecommunication systems, the features of the transmission of various signals through channels and paths  telecommunication systems. |  |
| 2. To design the SVOSP taking into account the physical processes in analog and digital devices for the formation, conversion and processing of optical signals, to evaluate the real and maximum capabilities of the bandwidth and noise stability of the SVOSP. |  |
| 3. To formulate the basic technical requirements for telecommunication networks and systems based on SVOSP, to assess the main problems associated with the operation and implementation of new telecommunications technology; |  |
| 4. Systematize the structure of devices for receiving and transmitting input-output multiplexers and regenerators |  |
| 5. Analyze the topology and route of the SVOSP and the design features of the developed and used radio-electronic means, switching and communication facilities;  6. Determine the basis for the construction and application of the SWOSP |  |
| **Prerequisites** | The study of the discipline "Radio engineering systems of information transmission" is based on knowledge of the fundamental laws of physics and higher mathematics, courses ORET-1 and ORET-2, the theory of transmission of electromagnetic waves. | |
| **Postrequisites** | Further study of modern systems of transmission and reception of information as; Radar, satellite communications system, satellite earth sensing system and global navigation system. | |
| **Informationresources** | 1. Тепляков И.М. Основы построения телекоммуникационных систем и сетей: Учеб. Пособие.-М.: Радио и связь,2014.-328с.  2. Винокуров В.М. Сети связи и системы коммутации. Учебное пособие для вузов-Томск, ТУСУР, 2016 - 303с.  3. Основы построения телекоммуникационных систем и сетей: Учебник для вузов/В.В. Крухмалев, В.Н.Гордиенко, А.Д. Моченов и др.; Под ред. В.Н.Гордиенко и В.В. Крухмалева.-М.: Горячая линия-Телеком,2014.-510с.  4. Телекоммуникационные системы и сети: Учебник / Под ред. В.П. Шувалова. – М.: Горячая линия – Телеком, 2013. – Т.1 – 647 с.  5. Телекоммуникационные системы и сети: Учебник /Г.П. Катунин, Г.В. Мамчев, В.Н. Попантонопуло; Под ред. В.П. Шувалова. – Н.: ЦЭРИС, 2019. – Т.2. – 623 с.  Интернет-ресурсы:  1.Электронный Журнал «Радиотехника и телекоммутация»  Доступно онлайн: Дополнительный учебный материал по дисциплине «Радиотехнические системы передачи информации», методические указания для практических и лабораторных занятий, задания для выполнения СРС будут доступны на вашей странице на сайте univer.kaznu.kz. в разделе УМКД. | |

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| **Academic policy of the course in the context of university moral and ethical values** | **Academic Behavior Rules:**  All students have to register at the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the discipline study schedule.  ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task is indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in the MOOC.  **Academic values:**  - Practical trainings/laboratories, IWS should be independent, creative.  - Plagiarism, forgery, cheating at all stages of control are unacceptable.  - Students with disabilities can receive counseling at e-mail \*\*\*\*\*\*\*@gmail.com. |
| **Evaluationandattestationpolicy** | **Criteria-based evaluation:**  assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams).  **Summative evaluation:** assessment of work activity in an audience (at a webinar); assessment of the completed task. |

**CALENDAR (SCHEDULE) THE IMPLEMENTATION OF THE COURSE CONTENT:**

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

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| Module **1** | | | | | | | |
| 1 | **L.1**Introduction. Modern fiber optic transmission systems (FOCS). Classificationandprinciplesofconstructionof SVOSP. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 1 | **PT 1**Study of methods for constructing modern fiber-optic systems for transmitting SVOSP | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 2 | **L.2**SVOSP structure. Optical transmitter. Optical receiver. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 2 | **PT 2**Study of optical transmitting and receiving modules. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 3 | **L.3**SWOSP equipment. Multiplexers. Repeaters. | LО 1 | ID 1.1. | 1 | 2 |  | Video lecture  in MS Teams |
| 3 | **PT 3**Exploring I / O multiplexers and hardware | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| **Module П** | | | | | | | |
| 4 | **L.4**Plesiochronous (PDH) and Synchronous Digital Hierarchy - (SDH). | LО 3 | ID 3.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 4 | **PT 4**Plesiochronous (PDH) and Synchronous Digital Hierarchy - (SDH). | LО 1 | ID 1.1. | 1 | 8 |  | Webinar  in MS Teams |
| 5 | **L.5**Parameters and configuration of single-fiber FOTS-SDI. | LО 4 | ID 4.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 5 | **PT 5**Study of the structure of single-fiber FOTS - SDI. | LО 1 | ID 1.1. | 1 | 8 | Logictask | Webinar  in MS Teams |
| 5 | **Make a structural and logical diagram of the read material** | LО 1 | ID 1.1. |  |  |  |  |
| 5 | **MT 1** | LО 1 | ID 1.1. | 1 | 50+ 50 |  |  |
| 6 | **L.6**Equipment for the digital hierarchy of single-wavelength FOTS. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 6 | **PT 6** Analysis of the structure given by the teacher of the SVOSP. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 7 | **L.7**Increasing the throughput of FOTS communication lines. TDM. FDM. MDM. PDM. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 7 | **PT 7**Study of codes with alternating pulse polarity. | LО 5 | ID 5.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 8 | **L.8**Synchronous digital telecommunication systems (STSTS). Conversion of signals to SCTS. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 8 | **PT 8**Study of the structure of the STM-1 transport module. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 9 | **L.9**Multi-wavelength optical carrier multiplexing - WDM. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 9 | **PT 9**Study of algorithms for forming STM-1 from containers VC-3 and VC-4. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 10 | **L.10**Opticalaccessnetworks. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 10 | **PT 10**Study of algorithms for forming STM-1 from low-level containers. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 10 | **МТ (MidtermExam)** | LО 1 | ID 1.1. | 1 | 50+ 50 |  |  |
|  | **Модуль 3** |  |  |  |  |  |  |
| 11 | **L.11**Multiplexers SCTS | LО 1 | ID 1.1. | 1 | 2 |  |  |
| 11 | **PT 11**Examining the multiplexer configuration. Block diagram of the multiplexer. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Video lecture  in MS Teams |
| 12 | **L.12**FOTS element base. Passive optical elements. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Webinar  in MS Teams |
| 12 | **PT 12**Study of the architecture of the transport network. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Video lecture  in MS Teams |
| 13 | **L.13Opticalcables.** | LО 1 | ID 1.1. | 1 | 2 | Logictask | Video lecture  in MS Teams |
| 13 | **PT 13**Studying the features of SDH technology. | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 14 | **L.14**Active quantum electronic fiber optic elements | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
| 14 | **PT 14**Study of NGSDH technology | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
| 15 | **L.15**Ways to create an optical global communication network. | LО 1 | ID 1.1. | 1 | 2 | Analysis | Video lecture  in MS Teams |
|  | **PT 15**Study of the second generation of NGSDH technology | LО 1 | ID 1.1. | 1 | 8 | Analysis | Webinar  in MS Teams |
|  | **Тест** | LО 1 | ID 1.1. |  |  |  |  |
|  | **MT 2** | LО 1 | ID 1.1. |  | 50+ 50 |  |  |

[Abbreviations: QS - questions for self-examination; TK - typical tasks; IT - individual tasks; CW - control work; MT - midterm.

Comments:

- Form of L and PT: webinar in MS Teams / Zoom (presentation of video materials for 10-15 minutes, then its discussion / consolidation in the form of a discussion / problem solving / ...)

- Form of carrying out the CW: webinar (at the end of the course, the students pass screenshots of the work to the monitor, he/she sends them to the teacher) / test in the Moodle DLS.

- All course materials (L, QS, TK, IT, etc.) see here (see Literature and Resources, p. 6).

- Tasks for the next week open after each deadline.

- CW assignments are given by the teacher at the beginning of the webinar.