MD-2045, CHIŞINĂU, STR. Studenţilor, 9/7, TEL: 022 50-99-08 [www.utm.md](http://www.utm.md)

Computer Networks

1. **Course unit / module data**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Faculty** | Computers, Computer Science and Microelectronics | | | | |
| **Departament** | Software and Automation Engineering | | | | |
| **Study cycle** | Undergraduate studies, cycle I | | | | |
| **Study program** | 0613.3 Software engineering (0613 Development of program products and applications) | | | | |
| **Year of study** | **Semester** | **Type of evaluation** | **Formative category** | **Optionality category** | **Credits ECTS** |
| II (full-time education) | 3 | E | S – specialized course unit | O - obligatory course unit | 5 |

1. **Estimated total time**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total hours in the curriculum | From which | | | | | |
| Auditorium hours | | Individual work | | | |
| Course | Laboratory | | Year project | Study of theoretical material | Application preparation |
| 150 | 30 | 45 | | - | 30 | 45 |

1. **Prerequisites for access to the course unit / module**

|  |  |
| --- | --- |
| According to the curriculum | Higher mathematics. Computer programming. Data structures and algorithms. Electronic circuits and devices. Analysis and synthesis of digital devices. |
| According to the competencies | Average knowledge of use and minimum knowledge of installation and configuration of operating systems (Windows, Linux, MacOS). Accessing and using the command line.  Abilities to install, configure and use system applications.  Elements of algorithm theory, graph theory and expectation theory. |

1. **Conditions for carrying out the educational process for**

|  |  |
| --- | --- |
| Course | Pentru prezentarea materialului teoretic în sala de curs este nevoie de tablă, proiector, PC/laptop și acces la Internet. Nu vor fi tolerate întârzierile studenţilor, precum şi convorbirile telefonice în timpul cursului. |
| Laboratory/ seminar | Students will be assessed through theoretical tests, practical work and, as appropriate, reports. Assessments will take place at least one week after the material has been taught in class. The deadline for taking the tests and / or laboratory work is no more than two weeks after their completion. For the late presentation of the tests or laboratory works, their evaluation will be scored with 1 point / week of delay. |

1. **Specific skills acquired**

|  |  |
| --- | --- |
| Professional skills | **C5*.*** **Competences regarding the architecture and infrastructure of computer systems**   * Identification and definition of architectural hardware, software and communications components, as well as those necessary to describe a computing infrastructure. * Explaining the interaction and operation of architectural and infrastructure components. * Application of basic methods for specifying architectural and infrastructure solutions to typical computational problems. * Use of criteria and methods for evaluating the functional and non-functional characteristics of system components.   Implementing an architectural and infrastructure solution based on stated constraints. |
| Transversal skills | **CT2*.*** Identifying, describing and carrying out the activities organized in a team with the development of communication and collaboration skills, but also with the assumption of different roles (execution and management).  **CT3*.*** Identify continuing vocational training needs, including the effective use of online communication and training resources (e-mail, online courses and other Internet resources). |

1. **Course unit / module objectives**

|  |  |
| --- | --- |
| General objective | Studying the theoretical aspects and training the basic practical skills regarding the architecture, operation, design, analysis and use of computer networks.  Training skills to use algorithms to solve problems in different fields |
| Specific objectives | Understanding and describing OSI ISO and TCP / IP network architectural models.  Understanding and describing the functionalities of computer network components.  Learning the basics of data transfer systems in networks.  Learning and applying IPv4 and IPv6 addressing.  Understanding and explaining WiFi, Ethernet, TCP / IP, ISDN, Frame Relay, ATM and MPLS network technologies.  Simple Ethernet networking skills.  Using instructions from the command line interface for basic configuration of a router and switch.  Use of tools to verify the operation and analysis of the use of computer network resources. |

1. **Content of the course unit / module**

|  |  |  |
| --- | --- | --- |
| The theme of teaching activities | Number of hours | |
| full-time education | part-time education |
| **The theme of the lectures** | | |
| T1. Introduction to networking  General notions regarding computer networks: definition, structure, components and role of computer networks in the information society. The evolution of computer systems from local systems to computer networks. Resource cooperation technologies, basic features and classification of computer networks. | 2 | 0,5 |
| T2. Network operating systems  General notions and basic functions of network operating systems. Specialized operating systems IOS, XE, XR, NX-OS, CatOS, RouterOS and SwOS. Basic configuration of a network operating system. | 2 | 0,5 |
| T3. Architectural models, protocols and network services  OSI ISO reference model. Architectural model and TCP / IP network protocols. Comparison of OSI ISO and TCP / IP models. Network services. | 2 | 0,5 |
| T4. Network addressing  Physical addresses of network entities. Addresses and IP address schemes. Dividing into subnets. IPv4 address types. IPv6 address. Switching from IPv4 to IPv6. | 2 | 1 |
| T5. Data transfer systems  Theoretical bases of data transfer: signals, transformation of messages into signals, Fourrier theorem, Nyquist theorem, Shannon formula. Point-to-point data transfer systems. Lines and communication channels. Data transfer channels. Circuit switching, multiplexing and concentration. | 2 | 0,5 |
| T6. Link layer  Services offered to the Network layer. Error detection and correction. Data link protocols. Control of access to the environment. | 2 | 0,5 |
| T7. Data transfer networks  Data transfer network (RTD) - the subnet of the computer network. Topological structures (forms) of RTD: classification, essence, characteristics. Switched data transfer networks. Comparative analysis of switching methods used in networks. Packet broadcast networks. | 2 | 0,5 |
| T8. Local computer networks  General notions regarding local computer networks. Local area network components. Topologies in local networks. Environmental access techniques in local networks. Local area network technologies. Switch configuration issues. | 2 | 0,5 |
| T9. Ethernet network technologies  Ethernet network technology. FastEthernet network technology. Gigabit Ethernet network technology. 10Gigabit Ethernet network technology. 40Gigabit Ethernet network technology. 100Gigabit Ethernet network technology. | 2 | 1 |
| **T10. Wireless networks**  General notions regarding wireless networks, classification. Peculiarities of electromagnetic wave propagation in terms of use in wireless networks. Peculiarities of access to the wireless environment. IEEE 802.11 network architecture. Operating modes of IEEE 802.11 networks. Bridges in wireless networks. WDS systems. How to operate the access points. Wireless network security. WPAN networks. | 2 | 1 |
| **T11. Design of local networks**  Aspects of designing local computer networks. Requirements for the physical configuration of Ethernet computer local area networks. Fragmentation of Ethernet networks. Methodology for calculating POS. PVV calculation methodology. Physical configuration of Fast Ethernet networks. Physical configuration of Gigabit Ethernet networks. | 2 | 0,5 |
| **T12. Network layer. Network routing**  Services offered to the Transport layer. Direction algorithms. Congestion control. Network interconnection. Network layer protocols in the Internet. Packet routing concepts. Internet routing protocols. | 2 | 1 |
| **T13. Routers**  Routers functions. Basic components of routers. Examples of routers. The basic configuration of a router. | 1 | 0,5 |
| **T14. Transport layer**  Services offered by the Transport layer. The basic functions of the Internet Transport layer. UDP protocol. TCP protocol. Other Internet Transport layer protocols. Network performance issues. | 2 | 1 |
| **T15. Application layer**  Basic functions of the Internet Applications layer. Network services. Layer Protocols Applications. DNS protocol. DHCP protocol. | 1 | 0,5 |
| **T16. Wide area computer networks**  Network technologies: TCP / IP, ISDN, Frame Relay, ATM and MPLS. Network access via DSL, ADSL, VDSL connections, cable modems, WiMax. Comparative feature of wide area network technologies. | 2 | 0,5 |
| **Total lectures:** | **30** | **10** |

|  |  |  |
| --- | --- | --- |
| The theme of teaching activities | Number of hours | |
| Full-time education | Part-time education |
| **The theme of laboratory works** | | |
| LL1. Exploring network functionality. | 2 | 1 |
| LL2. Basic configuration of a network operating system. | 4 | 1 |
| LL3. Communications and network protocols. | 4 | 1 |
| LL4. Network access. The Physical and Link layer. | 4 | - |
| LL5. Features and operation of Ethernet networks. | 2 | - |
| LL6. Network layer. Packet routing. | 2 | 1 |
| LL7. Performing the practical task in Packet Tracer no.1. | 4 | 1 |
| LL8. Transport layer. TCP and UDP protocols. | 2 | 0.5 |
| LL9. Applying IPv4 and IPv6 addressing. | 3 | 0.5 |
| LL10. Subnetwork of IP networks. | 6 | 0.5 |
| LL11. Application layer. | 4 | 0.5 |
| LL12. Interconnecting components and maintaining networks. | 4 | - |
| LL13. Performing the practical task in Packet Tracer no.2. | 4 | 1 |
| **Total laboratory work:** | **45** | **8** |

1. **Bibliographic references**

|  |  |
| --- | --- |
| Main | 1. E-learning platform CISCO netacad.com 2. Balchunas, Aaron. Cisco CCNA Study Gide. 2014. – 321 p. 3. Bolun, I.; Andronatiev, V. Internet şi Intranet. - Chişinău: Editura ASEM, 2014. - 456 p 4. Zota, Răzvan Daniel. Retele de calculatoare. – București: Editura ASE, 2014. – 205 p. 5. Moise, G.; Constantinescu, Z.; Vlădoiu, M.; Dumitru, M. Networking şi securitate. – Ploiesti: Editura Universității Petrol-Gaze, 2015. |
| More | 1. Олифер, В.Г.; Олифер, Н.А. Компъютерные сети. – СПб: Питер, 2010.  2. Nicolaescu, Ştefan-Victor. Telecomunicaţii moderne wireless. – București: Editura AGIR, 2015. – 424 p. |

1. **Evaluation**

|  |  |  |  |
| --- | --- | --- | --- |
| Current | | Year project | Final exam |
| Certification 1 | Attestation 2 |
| 30% | 30% | - | 40% |
| Minimum performance standard | | | |
| Attendance and activity at lectures and laboratory works;  Obtaining the minimum grade of "5" for each of the attestations and laboratory works;  Passing the final exam with a grade of "5". | | | |