**SYLLABUS**

**1. Information regarding the programme**

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| 1.1 Higher education institution | Babeş Bolyai University |
| 1.2 Faculty | Faculty of Mathematics and Computer Science |
| 1.3 Department | Department of Computer Science |
| 1.4 Field of study | Computer Science |
| 1.5 Study cycle | Bachelor |
| 1.6 Study programme / Qualification | Computer Science |

**2. Information regarding the discipline**

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|---|---|---|---|---|---|---|---|
| 2.1 Name of the discipline | Computer Networks | | | | | | |
| 2.2 Course coordinator | PhD. Assoc. Prof. Adrian Sergiu DARABANT | | | | | | |
| 2.3 Seminar coordinator | PhD. Assoc. Prof. Adrian Sergiu DARABANT | | | | | | |
| 2.4. Year of study | **2** | 2.5 Semester | **3** | 2.6. Type of evaluation | **E** | 2.7 Type of discipline | **Compulsory** |
| 2.8 Code of discipline | **MLE5002** | | | | | | |

**3. Total estimated time** (hours/semester of didactic activities)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Hours per week | 4 | 3.2 Of which: course | 2 | 3.3 seminar/laboratory | 2 |
| 3.4 Total hours in the curriculum | 56 | 3.5 Of which: course | 28 | 3.6 seminar/laboratory | 28 |
| Time allotment: | | | | | hours |
| Learning using manual, course support, bibliography, course notes | | | | | 20 |
| Additional documentation (in libraries, on electronic platforms, field documentation) | | | | | 20 |
| Preparation for seminars/labs, homework, papers, portfolios and essays | | | | | 30 |
| Tutorship | | | | | 11 |
| Evaluations | | | | | 13 |
| Other activities: ..... | | | | | - |

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| 3.7 Total individual study hours | 94 |
| 3.8 Total hours per semester | 150 |
| 3.9 Number of ECTS credits | 6 |

**4. Prerequisites** (if necessary)

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| 4.1. curriculum | • Operating Systems, Computer System Architecture |
| 4.2. competencies | • Basic knowledge on networking, basis of network security, data encryption algorithms. |

**5. Conditions** (if necessary)

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| 5.1. for the course | • Classroom with network and Internet access and to laboratory equipment. |
| 5.2. for the seminar /lab activities | • Laboratory with Internet connected computers; Linux and Windows; |

**6. Specific competencies acquired**

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| **Professional competencies** | • C6.1 Identification of basic concepts and models in computer networks and computer systems<br>• C6.2 Identification and explanation of basic architectures for systems and computer networks management.<br>• C6.5 Implementation and programming of computer networking projects.<br>• C6.6 Defining and implementing network device security policies. |
| **Transversal competencies** | • CT1 Applying organized and efficient work rules, responsible attitude towards scientific/ teaching domains in order to obtain a creative exploitation of own potential, while respecting the principles and rules of professional ethics<br>• CT3 Use of effective methods and techniques for learning, information, research and capacity to exploit knowledge, to adapt to a dynamic society and communication in Romanian language and in a foreign language<br>• CT4 Collaboration and data information sharing using digital technologies.<br>• CT5 Definition and application of behavioral norms in computer networks – Netiquette.<br>• CT6 Solving networking practical problems and situations. |

**7. Objectives of the discipline** (outcome of the acquired competencies)

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|---|---|
| 7.1 General objective of the discipline | • Be able to understand the fundamental principles and inner workings of a computer network and of Internet |
| 7.2 Specific objective of the discipline | • Learning the underlying concepts and principles of modern computer networks with emphasis on protocols, architectures, and implementation issues;<br>• Learning to program networking applications using TCP/IP<br>• Learning and understand the layered Internet protocols architecture<br>• Have all the basis knowledge about TCP/IP – theoretical aspects and programming communicating applications |

**8. Content**

| 8.1 Course | Teaching methods | Remarks |
|---|---|---|
| 1. Computer Networks Introduction. Definition. Examples. Network Topologies. | Exposure, conversation, explanation, didactical demonstration | |
| 2. The socket programming API. Network programming using TCP and UDP. | Exposure, conversation, explanation, didactical demonstration | |
| 3. Protocols: definition. Protocol layers. The OSI reference model. The TCP/IP layered model. | Exposure, conversation, explanation, didactical demonstration | |
| 4. The functions and services of the IP layer. Structure of an IP datagram. IP addressing (classfull). Datagram check summing. The ARP protocol. | Exposure, conversation, explanation, didactical demonstration | |
| 5. The concept of Subnetworks and Supernetworks. CIDR. Network masks. | Exposure, conversation, explanation, didactical demonstration | |
| 6. The UDP protocol and services. The structure of an UDP datagram UDP ports and processes. | Exposure, conversation, explanation, didactical demonstration | |

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|---|---|---|
| 7. The TCP protocol. Structure of a TCP segment. Principles of TCP data transmission. | Exposure, conversation, explanation, didactical demonstration | |
| 8. The TCP Sliding Window mechanism. Flow Control. Congestion avoidance. | Exposure, conversation, explanation, didactical demonstration | |
| 9. Broadcast and multicast communication. The ICMP protocol. Error and network state signaling. | Exposure, conversation, explanation, didactical demonstration | |
| 10. The application layer. HTTP, SMTP, FTP | Exposure, conversation, explanation, didactical demonstration | |
| 11. The Internet Domain Name System. The DNS protocol. | Exposure, conversation, explanation, didactical demonstration | |
| 12. Network routing. Distance based and link state based routing algorithms. Routing protocols: RIP, BGP, OSPF. | Exposure, conversation, explanation, didactical demonstration | |
| 13. The physical layer. Transmission media. Characteristics, fiber networks, wireless networks. Error detection and correction. | Exposure, conversation, explanation, didactical demonstration | |
| 14. Network Security; Netiquette and computer network behavior norms. | Exposure, conversation, explanation, didactical demonstration | |

**Bibliography**


1. J. Kurose, K. Ross, Computer Networking: A Top Down Approach, Addison-Wesley, rev2,3,4 2002-2007.
2. Douglas E. Comer, Internetworking with TCP/IP
   a. Vol 1- Principles, Protocols, and Architecture
   b. Vol 3- Client-Server Programming and Applications
3. G.R.Wright, R. Stevens, TCP/IP Illustrated – vol 1,2, Addison Wesley.
4. Matt Naugle, Illustrated TCP/IP – A Graphic Guide to protocol suite, John Willey & Sons, 1999.
5. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, UNIX® Network Programming Volume 1, Third Edition: The Sockets Networking API
6. Peterson, Larry - Davie, Bruce: Computer Networks: A Systems Approach. Morgan Kaufman, (3rd ed.), 2003.
7. Stallings, William: Data and Computer Communications. Prentice Hall, (6th ed.), 2000.
8. Tanenbaum, Andrew S.: Computer Networks. Prentice Hall, (4th ed.), 2003.
9. Dr. Nasrine Abushakra: Netiquette: Modern Manners For A Modern World: The Ultimate Guide To Online Etiquette, ISBN 1523817569, 2016


| 8.2 Seminar / laboratory | Teaching methods | Remarks |
|---|---|---|
| 1. Laboratory Configuration. Necessary tools, Virtual machines and build systems; | Explanation, dialogue, case studies, examples, proofs | |
| 2. A simple client-server TCP application; | Explanation, dialogue, case studies, examples, proofs | |
| 3. Concurrent TCP client-server applications; | Explanation, dialogue, case studies, examples, proofs | |
| 4. Concurrent Multiplexed TCP- Servers. The select call. Network debugging – wireshark | Explanation, dialogue, case studies, examples, proofs | |
| 5. Simple UDP client-server; Security Handling; | Explanation, dialogue, case studies, examples, proofs | |
| 6. Complex/Concurrent UDP applications. Ping. Traceroute. Ipconfig/ifconfig. | Explanation, dialogue, case studies, examples, proofs | |
| 7. TCP/IP programming -Mid term evaluation; | Practical tests | |
| 8. Packet Tracer - simple network simulation | Explanation, dialogue, case studies, examples, proofs | |
| 9. Packet Tracer - Physical/logical network design | Explanation, dialogue, case studies, examples, proofs | |

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| 10. Packet Tracer - Static Routing, NAT | Explanation, dialogue, case studies, examples, proofs | |
| 11. Packet Tracer – RIP Routing | Explanation, dialogue, case studies, examples, proofs | |
| 12. Packet Tracer – Packet filtering and VLANs | Explanation, dialogue, case studies, examples, proofs | |
| 13. Packet Tracer – Complex design | Explanation, dialogue, case studies, examples, proofs | |
| 14. Lab Evaluation. | Practical tests. | |

**Bibliography**


1. Douglas E. Comer, Internetworking with TCP/IP - Vol 3- Client-Server Programming and Applications
2. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, UNIX® Network Programming Volume 1, Third Edition: The Sockets Networking API
3. Cisco Networking Academy Classes, http://cisco.netacad.net


## 9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course respects the IEEE and ACM Curriculla Recommendations for Computer Science studies;
- The course exists in the studying program of all major universities in Romania and abroad;
- The content of the course covers the most important aspects necessary for a network engineer/architect in a network specialized company.

## 10. Evaluation

| Type of activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Share in the grade (%) |
|---|---|---|---|
| 10.4 Course | - know the basic principle of computer networks theory;<br>- apply the course concepts<br>- problem solving | Written exam- Moodle Test | 50% |
| 10.5 Seminar/lab activities | - TCP/IP programming skills and network simulation knowledge | - Mid-term and final term lab tests or overall lab grade (whichever applies) | 50% |
| 10.6 Minimum performance standards | | | |
| At least a grading of 5 (from a scale of 1 to 10) at both theoretical exam and laboratory assessments. | | | |

Date Signature of course coordinator Signature of seminar coordinator

.16/04/2024.... Assoc Prof. PhD Adrian Sergiu DARABANT Assoc Prof PhD Adrian Sergiu DARABANT

Date of approval Signature of the head of department

..... .Conf Dr Sterca Adrian