

“GHEORGHE ASACHI” TECHNICAL UNIVERSITY OF IAȘI
Faculty of Automatic Control and Computers
Department of Computer Science and Engineering
Competition for the position of Associate Professor, position no. 13
Subjects of the position: Computer Networks, Internet of Things

Thematic area
related to the lecture from the thematic area
for the competition for the academic position of associate professor no. 13
from the posts of the staff of the Department of Computer Engineering
for the academic year 2024-2025

Computer Networks

- Introduction to Computer Networks
 - Types of computer networks
 - Network structures and topologies
 - Reference models and protocol stacks (OSI and TCP/IP)
 - Reference models layers – purpose, services, common protocols
 - Latency, packet loss, and capacity in packet-switched networks
- Data Link Layer
 - Media access control mechanisms
 - Congestion control mechanisms
 - Local area networks (LANs)
 - Ethernet technologies (IEEE 802.3) – frame structure, addressing
 - Interconnection equipment
 - Virtual LANs (VLANs)
 - Preventing switching loops – STP, RSTP, MSTP protocols
- Network Layer
 - IPv4 and IPv6 protocols – addressing, packet structure, specific services
 - Network Address Translation (NAT) mechanism for IPv4
 - ARP protocol – discovering data link layer addresses
 - Routing algorithms – principles and categories
 - Router functionality – routing vs. packet forwarding
 - Packet routing on the Internet
 - Internet structure – autonomous systems, interconnection points
 - Interior gateway protocols – RIP, OSPF, IS-IS
 - Exterior gateway protocol – BGP
- Transport Layer
 - UDP protocol – addressing, packet structure, provided services
 - TCP protocol – addressing, packet structure, flow control, congestion control
- Applications and Services
 - ICMP and NDP protocols – auxiliary network layer services
 - DHCP protocol – dynamic IP address allocation
 - Electronic mail
 - DNS system
 - World Wide Web (WWW)

Internet of Things

- Introduction to IoT Concepts
 - Architecture types and network topologies

- Reference models, ontologies, classifications
- High-Level Elements
 - Architecture, services, and interaction models in the Cloud
 - MQTT, CoAP, and XMPP-IoT protocols
 - Data representation using SenML, NGSI-LD (JSON, CBOR)
- Access Infrastructure
 - Ad-hoc infrastructure – IEEE 802.11, Bluetooth (LE), IEEE 802.15.4 (ZigBee, 6LoWPAN)
 - Cellular infrastructure – NB-IoT, LTE-M
 - Long-range infrastructure – LoRaWAN, SigFox
- Embedded Devices in IoT
 - Structure and common subsystems of an IoT device
 - Power consumption sources in embedded systems/radio subsystems. Consumption models. Evaluation methods. Techniques for reducing power consumption.
- Fog, Edge, and Dew Computing Paradigms
- IoT-Specific Security Requirements. Overview of standards/frameworks for secure implementation of IoT systems - ETSI EN 303 645, IoT Security Compliance Framework, OWASP ISVS, ISA 99 / IEC 62443.

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- 1) Jim Kurose, Keith Ross, *Computer Networks: A Top-Down Approach (9th ed.)*, 2025, Pearson.
- 2) Andrew S. Tanenbaum, David J. Wetherall, *Computer Networks (6th. ed.)*, 2021, Pearson.
- 3) Charles M. Kozierok, *The TCP/IP Guide: A Comprehensive, Illustrated Internet Protocols Reference*, 2005, No Starch Press
- 4) S. Greengard, *The Internet of Thing*. Cambridge, Massachusetts: The MIT Press, 2021.
- 5) D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, and J. Henry, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1st edition*. Indianapolis, Indiana, USA: Cisco Press, 2017.
- 6) A. Kurniawan, *Internet of Things Projects with ESP32: Build exciting and powerful IoT projects using the all-new Espressif ESP32*. Birmingham, UK: Packt Publishing, 2019.
- 7) McEwen and H. Cassimally, *Designing the Internet of Things, 1st edition*. Chichester: Wiley, 2013.
- 8) Radu-Lucian Lupşa, *Reţele de calculatoare*, Casa Cărţii de Ştiinţă, 2008, ISBN 978-973-133-377-9.
- 9) Răzvan Rughiniş, Răzvan Deaconescu, Dorin Pena, Cosmin Stan, *Bazele administrării reţelelor locale*, Printech, 2005, ISBN 973-718-321-5.
- 10) Ion Bica, Mihai Togan, *Protocoale de securitate pentru reţelele de calculatoare*, 2015, Univers Ştiinţific. ISBN 978-973-1944-68-5.
- 11) Andy King, *Programming the Internet of Things: An Introduction to Building Integrated, Device-to-Cloud IoT Solutions*, 2021, O'Reilly Media.

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