COURSE DESCRIPTION CARD - SYLLABUS

Course name
Routing protocols [S1MiKC1>PRou]

Course

Field of study
Microelectronics and digital communications

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student enrolling in this course should have a basic understanding of computer networks. They should also possess the ability to independently acquire information from designated sources and demonstrate readiness to collaborate effectively within a team.

Course objective

The course aims to provide students with fundamental knowledge of routing mechanisms, algorithms, and protocols essential for the correct design and maintenance of packet-switched networks. Additionally, it seeks to develop students' problem-solving skills in addressing challenges encountered in the design and maintenance of wide-area networks (WANs) based on the IP protocol.

Course-related learning outcomes

Knowledge:
1. The studentd has a fundamental understanding of development trends in routing protocols.
2. The student has systematic, mathematical basic knowledge of the operation of routing algorithms and protocols.
3. The student has a well-organised knowledge of the key standards of modern intra-domain and inter-

domain routing protocols.
4. The student understands the basic principles of routing protocols in both wide-area (WAN) and local-area (LAN) packet networks.
5.The student has in-depth knowledge of the configuration of intra-domain routing protocols such as RIP, OSPF, and IS-IS, as well as a basic understanding of the configuration of the inter-domain routing protocol BGP.

Skills:
1. The student has the ability to configure network devices for routing protocols, including intra-domain protocols such as RIP, OSPF, and IS-IS, as well as the inter-domain protocol BGP.
2. The student can solve typical problems related to selecting the optimal routing protocol.

Social competences:
1. The student is aware of the limitations of their own knowledge and skills and understands the need for continuous learning in the areas of routing protocol design, operation, and configuration.
2. The student recognises that knowledge and skills related to routing protocols quickly become outdated.nderstands that knowledge and skills in the field of routing protocols very quickly become outdated.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge gained from lectures is assessed through a final assessment. The assessment is written and consists of 45-60 multiple-choice questions, true/false questions, and open-ended questions. Students receive one point for each correct answer, and a minimum of 50% of the total points is required to pass the assessment.
The knowledge and skills acquired in exercises are assessed based on student activity during classes (20%) and a final assessment (80%). The final assessment consists of 5-10 tasks to be solved, with the number of points awarded for each task depending on the complexity of the question. To pass the test, students must score at least 50% of the total points.

Programme content

1. IPv4 and IPv6 Address Space Management Methods (review)
2. Fundamental Principles of Routing in IP Networks
3. Classification and Characteristics of Routing Protocols
4. Configuration and Optimisation of Interior Routing Protocols (OSPF, IS-IS, RIPng)
5. Fundamentals of Inter-Domain Routing (BGP) and Traffic Control in the Internet
6. Network Performance Optimisation and Security of Routing Protocols

Course topics

Lecture Topics Overview
1.1. Addressing and Address Space Management
• Review of IPv4 and IPv6 Addressing Principles:
o Subnetting and supernetting (VLSM, CIDR)
o Address types (unicast, multicast, anycast)
o Dynamic and static IPv4/IPv6 address assignment methods (DHCP, SLAAC)
• Address Translation Mechanisms:
o NAT, NAT64, 6to4, Teredo
1.2. Introduction to Routing in IP Networks
• Classification of Routing Protocols:
o Interior Gateway Protocols (IGP): Distance-vector protocols, Link-state protocols
o Exterior Gateway Protocols (EGP): BGP and its applications
• Differences Between Dynamic and Static Routing
• Routing Algorithms:
o Bellman-Ford, Dijkstra
1.3. Interior Gateway Protocols (IGP)
• RIP v2 and RIPng:
o Structure, configuration, applications, limitations

• OSPF (Open Shortest Path First):
o OSPFv2 (IPv4): Fundamentals, areas, operational principles
o OSPFv3 (IPv6): Differences from OSPFv2, multi-instance support
o Multi-area OSPF: Normal, stub, and totally stubby areas
• IS-IS (Intermediate System to Intermediate System):
o Differences between IS-IS and OSPF
o IS-IS configuration for IPv4 and IPv6
1.4. Exterior Gateway Protocols (EGP)
• Fundamentals of BGP (Border Gateway Protocol):
o Characteristics of BGP and its role in the Internet
o BGP session maintenance mechanisms (keepalive, hold timer)
o Autonomous System (AS) structure and traffic control using BGP
• BGP Attributes and Their Impact on Routing:
o AS_PATH, LOCAL_PREF, MED
o Loop prevention mechanisms in BGP
o Load balancing in BGP
• Route Optimisation and Security Measures in Routing Protocols:
o Reducing router load through route aggregation
o Securing routing protocols (OSPF authentication, BGP route filtering, route-maps)

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board.
Laboratory: practical exercises in groups using Cisco/Huawei/Juniper routers or individually using simulators.

Bibliography

Basic:
1. Network routing: algorithms, protocols, and architectures / Deep Medhi, Karthik Ramasamy, MK Morgan Kaufmann Publishers, 2018.
2. Routing i switching: praktyczny przewodnik / Bruce Hartpence; Wydawnictwo Helion, 2013.
3. Sieci VPN. Zdalna praca i bezpieczeństwo danych. Wydanie II rozszerzone, Marek Serafin, Helion 2010.

Additional:
1. Teaching materials available on the cisco.netacad.net platform as part of the Cisco Network Academy conducted at the Institute of Communication and Computer Networks;
2. www.ietf.org

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00