Module/Course Syllabus
Computer Science
Mobile Application Development – Master degree programme

Course:	*Database administration*
Type of the course:	*Obligatory*
Course code:	SI03
Year:	1
Semester:	1
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*Write the total number of hours*
Lecture	*30*
Classes	-
Laboratory	*30*
Project	-
Number of ECTS credits:	*5*
Form of assessment:	*Test from lecture/Course completion assessment*
Course language:	*English*

Course objective (CO)	
CO1	*Knowledge of database system architecture*
CO2	*Ability to manage the logical data structures of a database system*
CO3	*Ability to manage the data structures of the database system*
CO4	*Ability to manage the memory structures of the database system*
CO5	*Ability to use SQL and PL / SQL to administrate the database*
CO6	*Ability to use the selected graphics tool to administrate the database*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Knowledge of relational databases*
2	*Knowledge of SQL basics*

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	*The student has a detailed and structured theoretical knowledge of database administration.*
LO 2	*The student has a detailed, structured theoretical knowledge of the structure of the database system.*
	In terms of skills:
LO3	*The student can create database with relevant relationships, create the database*

	structures and users and manage them as an administrator.
LO4	*The student can chose and evaluate the tools for database administration.*
LO5	*The student can use database languages to manage databases.*
	In terms of social competence:
LO6	*The student understands the need to deepen the knowledge of advanced database administration methods to improve the security.*

Course content	
Form of classes – lectures (L)	
	Course content
L1	*Introduction to database system architecture.*
L2	*Database instance, logical storage structure of database system data, such as: tablespace, blocks, areas or segments.*
L3	*Logical database structure, such as: tables, constraints, indexes, views, users, and schemas.*
L4	*Data database storage structures, such as: data files, logs, initialization parameters and backups.*
L5	*Database system memory structures: SGA, PGA, executable code area.*
L6	*SQL queries for database administration.*
L7	*Data Definition Language.*
L8	*Data Modification Language.*
L9	*Sequences, perspectives, and database indexes.*
L10	*Access permissions for users.*
L11	*PL/SQL language.*
L12	*Procedures and functions in PL / SQL language.*
L13	*Database packets, triggers.*
L14	*Database Cursors.*
Form of classes – laboratories (Lab)	
	Course content
Lab1	*Managing the logical storage structures of the database system.*
Lab2	*Checking the memory structures of database system.*
Lab3	*Managing the logical database structures and structures for storing data.*
Lab4	*SQL language for managing the database– basics.*
Lab5	*SQL language for managing he database– joins and aggregation functions.*
Lab6	Test.
Lab7	*Data Definition Language for managing the database.*
Lab8	*Data Modification Language for managing the database.*
Lab9	*Sequences, perspectives, and database indexes.*
Lab10	*Database users, permissions, and roles.*
Lab11	*PL/SQL language - basics.*
Lab12	*Procedures and functions in PL / SQL language.*
Lab13	*Cursors.*
Lab14	*Test.*
Lab15	*Assessment of the laboratory.*

Required textbooks and other course materials	
1	*Price Jason, Oracle Database 11g SQL, Mcgraw-Hill Publ.comp, 2007*
2	*Mclaughlin Michael, Oracle Database 11g PL/SQL Programming, Mcgraw-Hill Publ.comp., 2008,*
3	*Oracle Database 11g: A Beginner's Guide, Osborne, Mcgraw-Hill Professional, Mcgraw-Hill Publ.comp., 2008*
Recommended textbooks and other course materials	
1	*Database Administrator's Guide, https://docs.oracle.com/database/121/ADMIN/toc.htm*
2	*Oracle Database, http://docs.oracle.com/cd/E11882_01/server.112/e10897.pdf, August 2012*

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Module/Course Syllabus
Computer Science
2nd- degree programme

Course:	*Protocols and routing concepts*
Type of the course:	*Core/Obligatory*
Course code:	SI06
Year:	I
Semester:	I
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*75*
Lecture	*30*
Classes	*0*
Laboratory	*45*
Project	*0*
Number of ECTS credits:	*6*
Form of assessment:	*Examination*
Course language:	*English*

Course objective (CO)	
CO1	*Familiarize students with the advanced capabilities and confguration of the distance vector routing protocol.*
CO2	*Familiarize students with the advanced capabilities and confguration of the link state routing protocol.*
CO3	*Familiarize students with the advanced capabilities and confguration of the path vector routing protocol.*
CO4	*Familiarize students with advanced routing troubleshooting techniques*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Practical knowledge of computer networks course*
2	*Knowledge of IEEE802.x and TCP/IP network protocols*
3	*Ability to configure active network components (switches, routers, access points).*

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has advanced knowledge of distance vector, link state and path vector routing protocols algorithms.
LO 2	Student has advanced knowledge covering the configuration techniques of network routing.
LO 3	Student knows the methods, techniques, tools and materials used to solve

	complex engineering tasks in designing WAN networks.
	In terms of skills:
LO 4	Student is able to use configure advanced routing parameters in WAN networks.
LO 5	Student evaluates the suitability and use of specific routing protocols in different network environments.
LO 6	Can configure distance vector, link state and path vector routing protocols
	In terms of social competence:
LO 7	Student understands the need for lifelong learning; It can inspire and organize the learning process of others.
LO 8	Student is able to interact and work in a group.

Course content	
Form of classes – lectures (P)	
	Course content
L1	*Advanced Network and Routing Concepts. Differentiating Between Dynamic Routing Protocols. How Different Traffic Types, Network Types, and Overlaying Network Technologies Influence Routing. Differentiating Between the Various Branch Connectivity Options and Describing Their Impact on Routing Protocols. How to Configure Routing Information Protocol Next Generation (RIPng).*
L2	*Advanced Enhanced Interior Gateway Routing Protocol (EIGRP) routing implementation. Establishing EIGRP Neighbor Relationships.*
L3	*Building the EIGRP Topology Table. Optimizing EIGRP Behavior. Configuring EIGRP for IPv6. Named EIGRP Configuration.*
L4	*Advanced Open Short Path First (OSPF) routing implementation. Basic OSPF Configuration and OSPF Adjacencies. Configuration of Summarization and Stub Areas in OSPF. Configuration of OSPFv3 for IPv6 and IPv4.*
L5	*Manipulating Routing Updates. Basic OSPF Configuration and OSPF Adjacencies. How OSPF Builds the Routing Table. Configuration of Summarization and Stub Areas in OSPF. Configuration of OSPFv3 for IPv6 and IPv4*
L6	*Path Control Implementation. Using Cisco Express Forwarding Switching. Understanding Path Control. Implementing Path Control Using Policy-Based Routing. Implementing Path Control Using Cisco IOS IP SLAs.*
L7	*Enterprise Internet Connectivity. Planning Enterprise Internet Connectivity. Establishing Single-Homed IPv4 Internet Connectivity. Establishing Single-Homed IPv6 IPv6 Internet Connectivity. Improving Internet Connectivity Resilience.*
L8	*BGP Implementation. BGP Terminology, Concepts, and Operation. Implementing Basic BGP.*
L9	*BGP Attributes and the Path-Selection Process. Controlling BGP Routing Updates. Implementing BGP for IPv6 Internet Connectivity.*
L10	*Routers and Routing Protocol Hardening. Securing the Management Plane on*

	Cisco Routers. Describing Routing Protocol Authentication. Configuring Authentication for EIGRP. Configuring Authentication for OSPFv2 and OSPFv3. Configuring Authentication for BGP peers. Configuring VRF-lite

Course content	
Form of classes – laboratories (Lab)	
	Course content
Lab1	*Basic RIPng and Default Gateway Configuration.*
Lab2	*EIGRP Load Balancing. EIGRP Stub Routing.*
Lab3	*EIGRP for IPv6. Named EIGRP Configuration*
Lab4	*OSPF Virtual Links. Multi-Area OSPFv2 and OSPFv3 with Stub Area.*
Lab5	*Redistribution Between EIGRP and OSPF. Controlling Routing Updates.*
Lab6	*Configure and Verify Path Control Using PBR. Configure IP SLA Tracking and Path Control*
Lab7	*Configure NAT Services.*
Lab8	*Configuring BGP with Default Routing. Using the AS_PATH Attribute in BGP configuration.*
Lab9	*Configuring IBGP and EBGP Sessions, Local Preference, and MED. Configuration IBGP, Next Hop and Synchronization.*
Lab10	*Configuring MP-BGP. Routing Protocol Authentication.*

Required textbooks and other course materials	
1	*Wallace K., CCNP Routing and Switching ROUTE 300-101 Official Cert Guide, Pearson Eduation, Inc, 2015.*
2	*Bryant Ch., CCNP ROUTE 300-101 Study Guide, The Bryant Advantage, Inc, 2016.*
3	*Curriculum available at netacad.com (login required)*
Recommended textbooks and other course materials	
1	*Pioro M., Medhi D., Routing, Flow, and Capacity Design in Communication and Computer Networks, Elsevier Science, 2014.*
2	*White C. M., Data communications & computer networks : a business user's approach, Cengage Learning, 2016.*
3	*Mahbub Hassan , Raj Jain; High Performance TCP/IP Networking, Prentice Hall 2004*

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Module/Course Syllabus
Computer Science
2nd- degree programme

Course:	*Switching in local area networks*
Type of the course:	*Core/Obligatory*
Course code:	SI07
Year:	I
Semester:	II
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*75*
Lecture	*30*
Classes	*0*
Laboratory	*45*
Project	*0*
Number of ECTS credits:	*5*
Form of assessment:	*Examination*
Course language:	*English*

Course objective (CO)	
CO1	*Familiarize students with the advanced capabilities and confguration of the switch.*
CO2	*Familiarize students with the advanced capabilities and confguration of the VLANs and trunks in campus switched architecture*
CO3	*Familiarize students with the advanced capabilities and confguration of the Spanning Tree Protocol (STP).*
CO4	*Familiarize students with the advanced capabilities and confguration of switching features and technologies for the Campus Network.*
C05	*Familiarize students with advanced switching troubleshooting techniques.*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Practical knowledge of computer networks course*
2	*Knowledge of IEEE802.x and TCP/IP network protocols*
3	*Ability to configure active network components (switches, routers, access points).*

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has advanced knowledge of VLAN, STP, VTP, HSRP configuration.
LO 2	Student has advanced knowledge covering the configuration techniques of

	switching in layer 2 and 3.
LO 3	Student knows the methods, techniques, tools and materials used to solve complex engineering tasks in designing LAN networks.
	In terms of skills:
LO 4	Student is able to use configure advanced switching parameters in LAN networks.
LO 5	Student evaluates the suitability and use of specific switching protocols in different network environments.
LO 6	Srudent is able to use different switching features and technologies in Campus Networks.
	In terms of social competence:
LO 7	Student understands the need for lifelong learning; It can inspire and organize the learning process of others.
LO 8	Student is able to interact and work in a group.

Course content	
Form of classes – lectures (P)	
	Course content
L1	*Implementing Cisco IP Switched Networks review.*
L2	*Network Design Fundamentals. Campus network structure Introduction to Cisco switches and their associated architecture.*
L3	*Campus Network Architecture. Implementing VLANs and trunks in campus switched architecture. Understanding the concept of VTP and its limitation and configurations. Implementing and configuring EtherChannel*
L4	*Spanning Tree in Depth. Spanning Tree Protocol (STP) overview, its operations, and history. Implement Rapid Spanning Tree Protocol (RSTP). Describe how and where to configure the following features: PortFast, UplinkFast, BackboneFast, BPDU Guard, BPDU Filter, Root Guard, Loop Guard, Unidirectional Link Detection, and FlexLinks. Configure Multiple Spanning Tree (MST). Troubleshooting STP*
L5	*Inter-VLAN Routing. Given an enterprise network, design, implement, and verify inter-VLAN routing using an external router or a multilayer switch, using either switch virtual interfaces or routed interfaces. Understand Layer 3 EtherChannel and its configuration. Understand DHCP operation and its implementation and verification in a given enterprise network.*
L6	*First-Hop Redundancy. The need for first-hop redundancy protocols. HSRP overview. HSRP state transitions. Aligning HSRP with STP topology. Configuring and tuning HSRP. Load sharing with HSRP. Options HSRP has for tracking. Configuring HSRP interface tracking. Configuring object tracking in combination with HSRP. Configuring HSRP authentication Tuning HSRP timers. The differences between HSRP Versions 1 and 2.*
L7	*Network Management. AAA. Identity-based networking 802.1X. NTP. SNMP.*
L8	*Switching Features and Technologies for the Campus Network. Discovery*

	protocols. Unidirectional Link Detection. Power over Ethernet. SDM templates. Monitoring features. IP SLA.
L9	*High Availability. The need and basic idea behind switch stacking and VSS StackWise. The benefits of StackWise. Verifying StackWise. VSS. VSS benefits. Verifying VSS. Supervisor redundancy. Supervisor redundancy modes.*
L10	*Campus Network Security. Overview of switch security issues. Required best practices for basic security protection on Catalyst switches. Campus network vulnerabilities. Port security. Storm control. Mitigating spoofing attacks. DHCP snooping, IP Source Guard, and dynamic ARP inspection. Securing VLAN trunks. Private VLANs*

Course content	
Form of classes – laboratories (Lab)	
	Course content
Lab1	*Preparing switch for lab configuration*
Lab2	*Static VLANS, Trunking, and VTP.*
Lab3	*EtherChannel configuration.*
Lab4	*Implement Spanning Tree Protocols. Multiple Spanning Tree.*
Lab5	*Inter-VLAN Routing. Advanced DHCP configuration.*
Lab6	*First Hop Redundancy Protocols – HSRP and VRRP.*
Lab7	*Hot Standby Router Protocol for IPV6. Gateway Load Balancing Protocol (GLBP).*
Lab8	*Synchronizing Campus Network Devices using Network Time Protocol (NTP). Configure Campus Network Devices to support Simple Network Management Protocol (SNMPv3).*
Lab9	*IP Service Level Agreements and Remote SPAN in a Campus Environment.*
Lab10	*Securing Layer 2 Switches. Advanced Securing VLANs.*

Required textbooks and other course materials	
1	*Hucaby D., K., CCNP Routing and Switching SWITCH 300-115 Official Cert Guide, Pearson Eduation, Inc, 2015.*
2	*Bryant Ch., CCNP Switch 300-101 Study Guide, The Bryant Advantage, Inc, 2015.*
3	*Curriculum available at netacad.com (login required)*
Recommended textbooks and other course materials	
1	*Deal R., Medhi D., CCNP Switching Exam Cram, Coriolis Group, 2000.*
2	*Molenaar R., How to Master CCNP Switch, Createspace, 2013.*
3	*Mahbub Hassan , Raj Jain; High Performance TCP/IP Networking, Prentice Hall 2004*

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Module/Course Syllabus
Computer Science
2nd- degree programme

Course:	*Troubleshooting wide area networks*
Type of the course:	*Core/Obligatory*
Course code:	SI08
Year:	II
Semester:	III
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*75*
Lecture	*30*
Classes	*0*
Laboratory	*45*
Project	*0*
Number of ECTS credits:	*4*
Form of assessment:	*Examination*
Course language:	*English*

Course objective (CO)	
CO1	*Familiarize students with the advanced capabilities of the networks troubleshooting methods and procedures.*
CO2	*Familiarize students with the advanced capabilities of the networks troubleshooting methods and procedures.*
CO3	*Familiarize students with the advanced capabilities and confguration of the path vector routing protocol.*
CO4	*Familiarize students with advanced troubleshooting case study tasks.*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Practical knowledge of computer networks course*
2	*Knowledge of IEEE802.x and TCP/IP network protocols*
3	*Ability to configure active network components (switches, routers, access points).*

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has advanced knowledge of distance vector, link state and path vector routing protocols algorithms.
LO 2	Student has advanced knowledge covering the specialized maintenance and troubleshooting tools.
LO 3	Student knows the methods, techniques, tools and materials used to solve

	complex engineering tasks in designing LAN and WAN networks.
	In terms of skills:
LO 4	Student is able to use trubleshoot advanced routing nad switching parameters in LAN and WAN networks.
LO 5	Student evaluates the suitability and use of specific troubleshooting methods in different network problems.
LO 6	Can troubleshoot common issues with various routing and switching protocols.
	In terms of social competence:
LO 7	Student understands the need for lifelong learning; It can inspire and organize the learning process of others.
LO 8	Student is able to interact and work in a group.

Course content	
Form of classes – lectures (P)	
	Course content
L1	*Troubleshooting Methods. Troubleshooting principles. Common troubleshooting approaches. Troubleshooting example using six different approaches.*
L2	*Structured Troubleshooting. Meaning of structured troubleshooting method and procedure. The subprocesses of structured troubleshooting, the actions taken within each subprocess, and how and when you move from one to another progressively. Troubleshooting example utilizing the structured troubleshooting method and procedures.*
L3	*Network Maintenance Tasks and Best Practices. Structured network maintenance. Network maintenance processes and procedures. Network maintenance services and tools. Integrating troubleshooting into the network maintenance process.*
L4	*Basic Switching and Routing Process and Effective IOS Troubleshooting Commands. Basic Layer 2 switching process. Basic Layer 3 routing process. Selective information gathering using IOS show commands, debug commands, ping, and Telnet.*
L5	*Using Specialized Maintenance and Troubleshooting Tools. Categories of troubleshooting tools. Traffic-capturing features and tools. Information gathering with SNMP. Information gathering with NetFlow. Network event notification with EEM.*
L6	*Troubleshooting Case Study 1. Troubleshooting Ethernet Trunks. Troubleshooting NAT. Troubleshooting Network Device Interfaces. Troubleshooting IPv6 Address Assignment on Clients.*
L7	*Troubleshooting Case Study 2. Troubleshooting BGP Neighbor Relationships Troubleshooting Port Security. Troubleshooting VLANs. Troubleshooting GW1's OSPF Neighbor Relation Problem with Router R1. Troubleshooting OSPF Adjacency. Troubleshooting SSH and Telnet. Troubleshooting HSRP.*
L8	*Troubleshooting case study 3. Troubleshooting EIGRP Adjacency.*

	Troubleshooting BGP. Troubleshooting NTP. Disaster Recovery Best Practices. Troubleshooting Inter-VLAN Routing. Troubleshooting DNS. Remote Device Management Notes.
L9	*Troubleshooting case study 4. Troubleshooting Redistribution. Troubleshooting VRRP with Interface Tracking. FHRP Tracking Options. Troubleshooting IP SLA. Troubleshooting EIGRP Summarization. Troubleshooting RIPng. Troubleshooting Access Control Lists.*
L10	*Troubleshooting case study 5. Troubleshooting Spanning Tree Protocol. Troubleshooting Policy-Based Routing. Troubleshooting CDP and LLDP. Troubleshooting VTP. Troubleshooting EIGRP for IPv6. Troubleshooting MP-BGP. Troubleshooting the OSPFv3 Address Families Feature.*

Course content	
Form of classes – laboratories (Lab)	
	Course content
Lab1	*Assembling Maintenance and Troubleshooting Tools.*
Lab2	*Troubleshooting Layer 2 Issues. Mixed Layer 2-3 Connectivity.*
Lab3	*Troubleshooting DHCP redundancy and stronger authentication, as well as a consolidated and integrated FHRP solution for IPv4 and IPv6.*
Lab4	*Diagnose and resolve problems related to IP addressing and NAT. Diagnose and resolve problems related to IP addressing and DHCP.*
Lab5	*Diagnose and resolve problems related to the OSPF routing protocol. Diagnose and resolve problems related to route redistribution.*
Lab6	*Diagnose and resolve problems related to switch virtual interfaces and multilayer switching. Diagnose and resolve problems related to EIGRP.*
Lab7	*Diagnose and resolve problems related to the BGP exterior routing protocols.*
Lab8	*Diagnose and resolve problems related to switch virtual interfaces and multilayer switching. Diagnose and resolve problems related to First Hop Redundancy Protocols. Diagnose and resolve problems related to basic routing.*
Lab9	*Diagnose and resolve problems related to AAA, LLDP, port security, FHRP interface tracking, FHRP IP SLA object tracking, MST, VTP, ACLs, route authentication, VRF, and BGP.*
Lab10	*Diagnose and resolve problems related to features, protocols, or technology that could be encountered in a complex, integrated enterprise network.*

Required textbooks and other course materials	
1	*Wallace K., CCNP Routing and Switching TSHOOT 300-135 Official Cert Guide, Pearson Eduation, Inc, 2015.*
2	*Molenaar R., How to Master CCNP TSHOOT,* CreateSpace*, Inc, 2013.*
3	*Curriculum available at netacad.com (login required)*
Recommended textbooks and other course materials	
1	*Pioro M., Medhi D., Routing, Flow, and Capacity Design in Communication and Computer Networks, Elsevier Science, 2014.*

2	*Helfrich D., Ronnau L, Frazier J., Forbes J., Cisco Network Admission Control, Volume I: NAC Framework Architecture and Design,Cisco Press, 2006.*
3	*Mahbub Hassan , Raj Jain; High Performance TCP/IP Networking, Prentice Hall 2004*
4.	*Scrimger R., LaSalle P., Parihar M., Gupta M., TCP/IP Bible, Wiley, 2001.*

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Module/Course Syllabus
Computer Science
2nd- degree programme

Course:	*Mobility and multimedia in IP networks*
Type of the course:	*Core/Obligatory/Elective*
Course code:	SI10
Year:	II
Semester:	III
Form of the degree programme:	*Full-time/Part-time*
Form of classes and number of hours per semester:	*60*
Lecture	*30*
Classes	*0*
Laboratory	*30*
Project	*0*
Number of ECTS credits:	*2*
Form of assessment:	*Exam*
Course language:	*Polish / (English – option)*

Course objective (CO)	
CO1	*To acquire knowledge, competence and practical skills in the representation, generation, storage and processing of multimedia data and mechanisms for their effective transmission in modern computer networks.*
CO2	*Familiarity with protocols and mechanisms also used in mobile technologies.*
CO3	*The fudamentals of problem detection and security in multimedia data transmissions.*

Prerequisites in terms of knowledge, skills and other competencies	
1	Fundamentals of computer networks
2	Multimedia fundamentals

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has basic knowledge about presentation, generation, storage and processing of multimedia data streams and mechanisms of their effective transmission in modern computer networks.
LO 2	Student has basic knowledge of mobile technologies
	In terms of skills:
LO 3	The student has an extensive knowledge of IP multimedia protocols and

	basic configuration skills
	In terms of social competence:
LO 4	Student understands the need to improve the administrator's workshop

Course content	
Form of classes – lectures (L)	
	Course content
L1	*Introduction.*
L2	*Multimedia in computer networks and communication.*
L3	*Multimedia data processing - goals and challenges.*
L4	*Preparation of multimedia signal for transport (1/2).*
L5	*Preparation of multimedia signal for transport (2/2).*
L6	*IP networks packet based transmission fundamentals*
L7	*The specificity of multimedia wireless networking*
L8	*Test (1/2)*
L9	*Architecture and features of selected multimedia transmission solutions*
L10	*Selected issues in multimedia data transmission*
L11	*Quality of Services*
L12	*Safety in multimedia data transmission*
L13	*Decentralized (P2P) and mobile systems*
L14	*Revise and summarize of the lecture*
L15	*Test (2/2)*
Form of classes – laboratories (Lab)	
	Course content
Lab1	Lab safety rules. Organization issues.
Lab2	Hardware familiarizing. Working with various wireless topologies.
Lab3	Wireless networks security methods
Lab4	Basics configuration of IP networks active devices.
Lab5	VPN tunnel configuration
Lab6	Static routes
Lab7	DHCP and IPv6 configurtion
Lab8	Basic VoIP implementation
Lab9	Streaming media exchange system DLNA / JetCast based
Lab10	Repetition term / Final grades

Required textbooks and other course materials	
1	*Chen C.W., Li Z., Shiguo L.: Intelligent Multimedia Communication: Techniques and Applications, Springer 2010.*
2	*Chou P.A., van der Schaar M.: Multimedia over IP and Wireless Networks Compression, Networking and Systems, Elsevier 2007.*
3	*Demetriades G.C.: Streaming Media. Building and Implementing a Complete Streaming System, Wiley Publishing 2003.*
4	*Estrin D. i in.: Protocol Independent Multicast – Sparse Mode: Protocol*

	Specification, RFC 2362, 1998
5	*Fa-Long L.: Mobile Multimedia Broadcasting Standards Technology and Practice, Springer Science+Business Media 2009.*
6	*Follansbee J.: Get Streaming! Quick Steps to Delivering Audio and Video Online, Elsevier 2004.*
7	*Chen C.W., Li Z., Shiguo L.: Intelligent Multimedia Communication: Techniques and Applications, Springer 2010.*
Recommended textbooks and other course materials	
1	*Antosik B.: Transmisja internetowa danych w czasie rzeczywistym, WKŁ 2010*
2	*Gromaszek K., Wójcik W. [Red:].: Sieci komputerowe, Lublin: Komitet Inżynierii Środowiska PAN, 2011, 221 s.*

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Module/Course Syllabus
Computer Science
2nd- degree programme

Course:	*Computer networks project 1*
Type of the course:	*Core/Obligatory*
Course code:	SI13
Year:	I
Semester:	II
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*30*
Lecture	*0*
Classes	*0*
Laboratory	*0*
Project	*30*
Number of ECTS credits:	*2*
Form of assessment:	*Assessmwnt*
Course language:	*English*

Course objective (CO)	
CO1	*Familiarize students with the LAN networks protocols current state of art.*
CO2	*Students learn the principles of correct LAN design on ISO/OSI model layers II-VII.*
CO3	*Students familiarize with methods of components parameters selection and protocols used in modern computer networks.*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Practical knowledge of handle Windows and Linux operating systems*
2	*Knowledge of IEEE802.x and TCP/IP network protocols*
3	*Ability to configure LAN components (switches, routers, access points).*

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has basic knowledge of development trends and most important achievements in the LAN computer networks construction and design.
LO 2	Student has basic knowledge covering the techniques of network traffic engineering used in LANs.
LO 3	Student knows the basic methods, techniques, tools and materials used to solve complex engineering tasks in designing LAN networks.
	In terms of skills:

LO 4	Student is able to use information and communication techniques appropriate to the tasks typical of engineering activities
LO 5	Student evaluate the suitability and use of new achievements (techniques and technologies) in the field of LAN network design.
LO 6	Student can, according to its specific nature, take into account the non-technical aspects of designing a complex device, object, system or process related to the design of LAN computer networks and implement this project in at least in part using appropriate methods, techniques and tools, including adapting existing or developing new tools
	In terms of social competence:
LO 7	Student understands the need to improve the administrator's workshop Understands the need for lifelong learning; It can inspire and organize the learning process of others.
LO 8	Student is able to interact and work in a group, accepting roles in it.

Course content	
Form of classes – project (P)	
	Course content
P1	*Presentation of equipment and principles of use of the accumulated hardware and software. Discussing project topics in terms of scope and final objectives. Division into thematic groups. Analysis of individual projects. Defining the tasks in each of them. Analysis of alternatives.*
P2	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 1. Discussion and evaluation of results of the implementation of the partial task no. 1*
P3	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 2. Discussion and evaluation of results of the implementation of the partial task no. 2.*
P4	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 3. Discussion and evaluation of results of the implementation of the partial task no. 3.*
P5	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 4. Discussion and evaluation of results of the implementation of the partial task no. 4.*
P6	*Discussion of the testing procesures and verification of project objectives. Analysis of the completeness of the test plan and it's objectives. Projet testing and verification.*
P7	*Testing and verification of the project. Discussion and evaluation of the functionality achievements and project objectives.*

Required textbooks and other course materials	
1	*Andrew S. Tanenbaum, David J. Wetherall; Computer Networks, Prentice Hall 2014*
2	*Oppenheimer P., Cisco. Top-Down Network Design (3rd Edition) (Networking*

	Technology), Cisco Press 2012
3	*Mahbub Hassan , Raj Jain; High Performance TCP/IP Networking, Prentice Hall 2004*
Recommended textbooks and other course materials	
1	*Pioro M., Medhi D., Routing, Flow, and Capacity Design in Communication and Computer Networks, Elsevier Science, 2014.*
2	*White C. M., Data communications & computer networks : a business user's approach, Cengage Learning, 2016.*
3	*Gromaszek K., Wójcik W. [Red:].: Sieci komputerowe, Lublin: Komitet Inżynierii Środowiska PAN, 2011, 221 s.*

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Module/Course Syllabus
Computer Science
2nd- degree programme

Course:	*Computer networks project 2*
Type of the course:	*Core/Obligatory*
Course code:	SI14
Year:	II
Semester:	III
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*30*
Lecture	*0*
Classes	*0*
Laboratory	*0*
Project	*30*
Number of ECTS credits:	*2*
Form of assessment:	*Assessmwnt*
Course language:	*English*

Course objective (CO)	
CO1	*Familiarize students with the campus and virtual networks protocols current state of art.*
CO2	*Students learn the principles of campus and virtual networks design on ISO/OSI model layers II-VII.*
CO3	*Students familiarize with methods of components parameters selection and protocols used in campus and virtual networks.*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Practical knowledge of handle Windows and Linux operating systems*
2	*Knowledge of IEEE802.x and TCP/IP network protocols*
3	*Ability to configure LAN components (switches, routers, access points).*
4	*Knowledge of IT resources virtualization*

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has basic knowledge of development trends and most important achievements in the campus and virtual networks construction and design.
LO 2	Student has basic, theoretical knowledge covering the techniques of network traffic engineering used in campus and virtual networks

LO 3	Student knows the basic methods, techniques, tools and materials used to solve complex engineering tasks in designing campus and virtual networks.
	In terms of skills:
LO 4	Student is able to use information and communication techniques appropriate to the tasks typical of engineering activities
LO 5	Student evaluate the suitability and use of new achievements (techniques and technologies) in the field of LAN network design.
LO 6	Student can, according to its specific nature, take into account the non-technical aspects of designing a complex device, object, system or process related to the design designing campus and virtual networks and implement this project in at least in part using appropriate methods, techniques and tools, including adapting existing or developing new tools
	In terms of social competence:
LO 7	Student understands the need to improve the administrator's workshop Understands the need for lifelong learning; It can inspire and organize the learning process of others.
LO 8	Student is able to interact and work in a group, accepting roles in it.

Course content	
Form of classes – project (P)	
	Course content
P1	*Presentation of equipment and principles of use of the accumulated hardware and software. Discussing project topics in terms of scope and final objectives. Division into thematic groups. Analysis of individual projects. Defining the tasks in each of them. Analysis of alternatives.*
P2	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 1. Discussion and evaluation of results of the implementation of the partial task no. 1*
P3	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 2. Discussion and evaluation of results of the implementation of the partial task no. 2.*
P4	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 3. Discussion and evaluation of results of the implementation of the partial task no. 3.*
P5	*Discussion and evaluation of the selection of techniques and technologies necessary for the performance of the partial task no. 4. Discussion and evaluation of results of the implementation of the partial task no. 4.*
P6	*Discussion of the testing procesures and verification of project objectives. Analysis of the completeness of the test plan and it's objectives. Projet testing and verification.*
P7	*Testing and verification of the project. Discussion and evaluation of the functionality achievements and project objectives.*

Required textbooks and other course materials	
1	*Andrew S. Tanenbaum, David J. Wetherall; Computer Networks, Prentice Hall 2014*
2	*Oppenheimer P., Cisco. Top-Down Network Design (3rd Edition) (Networking Technology), Cisco Press 2012*
3	*Mahbub Hassan , Raj Jain; High Performance TCP/IP Networking, Prentice Hall 2004*
Recommended textbooks and other course materials	
1	*Pioro M., Medhi D., Routing, Flow, and Capacity Design in Communication and Computer Networks, Elsevier Science, 2014.*
2	*White C. M., Data communications & computer networks : a business user's approach, Cengage Learning, 2016.*
3	*Gromaszek K., Wójcik W. [Red:].: Sieci komputerowe, Lublin: Komitet Inżynierii Środowiska PAN, 2011, 221 s.*

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Module/Course Syllabus
[Name of the field of study]
…- degree programme

Course:	*Operating systems for mobile platforms*
Type of the course:	*Core/Obligatory/Elective*
Course code:	SI02
Year:	
Semester:	
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*60*
Lecture	*30*
Classes	*0*
Laboratory	*30*
Project	*0*
Number of ECTS credits:	*5*
Form of assessment:	*Examination*
Course language:	*English*

Course objective (CO)	
CO1	To familiarize students with operating systems on mobile platforms
CO2	To familiarize students with the means to create custom applications for mobile platforms

Prerequisites in terms of knowledge, skills and other competencies	
1	Knowledge in fundamentals of operating systems.
2	Knowledge in fundamentals of computer architecture
3	Basic knowledge of Java programming

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Student has broadened and deepened knowledge of operating systems
LO 2	Student has knowledge of development trends and most important new developments in operating systems for mobile platforms
LO 3	Student has knowledge of operating systems for mobile platforms
	In terms of skills:
LO 4	Student can use developer tools for Android and Windows Mobile
LO 5	Student has knowledge of selected API system functions

LO 6	Student can write an application for mobile devices using available resources and programming techniques
	In terms of social competence:
LO 7	Student can work in a small team.

Course content	
Form of classes – lectures (L)	
	Course content
L1	The specificity of mobile hardware platforms, differences with respect to fixed, system architecture solutions
L2	The specificity of operating systems for mobile platforms, the basis of operating system architecture
L3	Mobile systems as real-time systems, system kernel
L4	Support for mobile platform devices - keyboard, screen, phone, GPS, sensors.
L5	Graphics in mobile systems
L6	Computer networks on mobile platforms WiFi, WiMax, LTE, Bluetooth, etc.
L7	Security of mobile systems
L8	Android features and development tools for Android system
L9	Features of Microsoft's mobile operating systems
L10	Characteristics of iOS and Blackberry. Bada, Symbian and other niche systems
L11	Development Trends and Mobile Systems Market
Form of classes – laboratories (Lab)	
	Course content
Lab1	Introductory classes: Health and safety at work; laboratory equipment; how to prepare reports; laboratory scoring mode.
Lab2	Android - programming environment, graphical user interface, wireless communication, mobile database, other on-board resources
Lab 3	Windows Mobile - programming environment, graphical user interface, wireless communication, mobile database, other on-board resources
Lab 4	Integration of resources on chosen platform
Lab 5	Final evaluation of work

Required textbooks and other course materials	
1	Shane Conder, Lauren Darcey, Introduction to Android Application Development: Android Essentials (5th Edition) (Developer's Library), Adison-Wesley, 2010
2	Andy Wigley; Daniel Moth; Peter Foot: Microsoft Mobile Development Handbook, Microsoft Press 2007
Recommended textbooks and other course materials	
1	Web resources

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Module/Course Syllabus
[Name of the field of study]
…- degree programme

Course:	*Operating systems for mobile platforms*
Type of the course:	*Core/Obligatory/Elective*
Course code:	SI01
Year:	1
Semester:	1
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*60*
Lecture	*30*
Classes	*0*
Laboratory	*30*
Project	*0*
Number of ECTS credits:	*6*
Form of assessment:	*Examination*
Course language:	*English*

Course objective (CO)	
CO1	Understanding basic information about the creation, operation and exploitation of technical resources constituting broadly understood ICT.
CO2	Know how to process, transfer and manage information in computer telecommunication networks
CO3	Knowledge in the field of structural networks.

Prerequisites in terms of knowledge, skills and other competencies	
1	Fundamentals of telecommunication
2	Fundamentals of digital signal processing
3	Fundamentals of computer networks

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	The student has a knowledge in the field of building IT networks
LO 2	The student has a knowledge in the field of data transmission systems, data processing and service management.
	In terms of skills:
LO 4	Student can build a model of the IT network

LO 5	The student is able to prepare tests of teleinformatic systems and can draw basic conclusions from the obtained test results
LO 6	The student is able to critically analyse the operation of the IT network and evaluate the quality of services
	In terms of social competence:
LO 7	The student is aware of the need for further training as a consequence of the dynamic development of ICT

Course content	
Form of classes – lectures (L)	
	Course content
L1	Basic definitions. Types of information systems and their description.
L2	Mathematical and physical basis of telecommunications. Elements of information theory. Sources of information, their models and properties.
L3	Model of telecommunication system. Transmitter and receiver functions.
L4	Concept and basic types of modulation. Track, channel, and link concepts. Analog and digital signals. Signal spectrum.
L5	OSI Model - ISO as the primary standard for teleinformatic communication. . Elements of telecommunications network.
L6	Commutation. Teletransmission channel.
L7	Elements of a computer network. Analogies of both types of networks and their components - teleinformatic network.
L8	Data transmission protocols. Control protocols.
L9	Information security.
L10	Network connection rules. Distribution of information resources and their flow.
L11	Measures and standards for information transfer. Standardisation.
	Development trends of ICT.
Form of classes – laboratories (Lab)	
	Course content
Lab1	Introductory classes: Health and safety at work; laboratory equipment; how to prepare reports; laboratory scoring mode.
Lab2	Data transmission, elements of the transmission path, devices
Lab 3	Detection and correction of errors in data transmission
Lab 4	Coexistence of Wi-Fi and Bluetooth
Lab 5	Method of compressing information in a network
Lab 6	Testing access link speed
Lab 7	Performance evaluation of WAN applications
Lab 8	Testing changes in the PVC circuit speed of the FrameRelay link

Required textbooks and other course materials	
1	Haykin Simon. Communication Systems, John Wiley & Sons Ltd, Chichester, 2009
2	Norris, M, Communications Technology Explained, John Wiley & Sons Ltd, Chichester, 2000
Recommended textbooks and other course materials	
1	Web resources

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Module/Course Syllabus
[Name of the field of study]
…- degree programme

Course:	*Network Servers Administration*
Type of the course:	*Obligatory*
Course code:	SI04
Year:	I
Semester:	I
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*60*
Lecture	*30*
Classes	*0*
Laboratory	*30*
Project	*0*
Number of ECTS credits:	*6*
Form of assessment:	*Examination*
Course language:	*Polish*

Course objective (CO)	
CO1	*The aim of the course is to provide knowledge and skills about roles and features of network servers.*
CO2	*Provides knowledge and skills about deployment, configuration, monitoring and security of Windows servers.*

Prerequisites in terms of knowledge, skills and other competencies	
1	High school course in computer (TCP/IP) networks.

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Have a good understanding of basic networking and network connection
LO 2	Have an understanding of network name resolution
LO 3	Student has organized knowledge of network access infrastructure
LO 4	Student has basic knowledge of server and services monitoring
	In terms of skills:
LO 5	Student is able to configure basic networking and connections on servers
LO 6	Student knows how to plan and deploy name resolution infrastructure
LO 7	Student knows how to design and configure network access infrastructure
LO 8	Student is able to monitor network servers and services.

	In terms of social competence:
LO 9	Student understands the need to constantly acquire knowledge about continuously changing servers and networking technology

Course content	
Form of classes – lectures (L)	
	Course content
L1	*Features and roles of Windows servers*
L2	*Hyper-V server virtualization*
L3	*Network file services*
L4	*Distributed file systems*
L5	*WINS services*
L6	*DHCP services*
L7	*DNS services*
L8	*Network policy server*
L9	*Network access server*
L10	*Active Directory services*
L11	*Network protection with IPSec*
L12	*Remote desktop services*
L13	*Security of network servers*
L14	*Monitoring of network servers*
L15	*Documentation and planning of network servers*
Form of classes – laboratories (Lab)	
	Course content
Lab1	Hyper-V virtualization
Lab2	Basic networking and network connection
Lab3	File and DHCP servers
Lab4	Name resolution servers
Lab5	Active Directory services
Lab6	Distributed File Systems, IPSec
Lab7	Remote access servers, network policy servers
Lab8	Remote desktop services
Lab9	Monitoring of network servers, Quality of Services
Lab10	Network servers security and protection

Required textbooks and other course materials	
1	C. Zacker: Installing and Configuring Windows Server 2012, Microsoft Press, 2012.
2	W. R. Stanek: Windows Server 2008 Inside Out, Microsoft Press, Redmont, 2008
3	J. Davies, T. Northrup: Windows Server 2008 Networking and Network Access Protection (NAP), Microsoft Press, 2008
Recommended textbooks and other course materials	

1	J.C. Mackin, T. Northrup: Configuring Windows Server 2008 Network Infrastructure, Microsoft Press, 2008
2	J. Johansson, Microsoft MVP: Windows Server Security Resource Kit, Microsoft Press, Redmont, 2008
3	O. Tginas: Administering Windows Server 2012, Training Guide,OReilly Media, 2013.

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Module/Course Syllabus
[Name of the field of study]
…- degree programme

Course:	*Computer System Reliability*
Type of the course:	*Obligatory*
Course code:	SI12
Year:	I
Semester:	II
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*60*
Lecture	*30*
Classes	*0*
Laboratory	*30*
Project	*0*
Number of ECTS credits:	*6*
Form of assessment:	*Examination*
Course language:	*Polish*

Course objective (CO)	
CO1	*The aim is to provide knowledge about theory and models of reliability.*
CO2	*Provides knowledge about computer system and network reliability*
CO3	*To enable the students to acquire knowledge about methods and techniques of high availability of computer networks and systems.*
CO4	*Provide students with skills including selecting, application and configuration of computer system high availability.*

Prerequisites in terms of knowledge, skills and other competencies	
1	High school course in mathematics
2	High school course in computer (TCP/IP) networks.
3	High school course of operational systems

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Have a good understanding of basic terms of reliability
LO 2	Have an understanding of computer systems reliability
LO 3	Student has organized knowledge of methods of increasing reliability and high availability
LO 4	Student has basic knowledge of computer system recovery and failback

	In terms of skills:
LO 5	Student is able to model reliability of elements and systems
LO 6	Student knows how to analyse and calculate system reliability
LO 7	Student knows how to select techniques for increasing reliability and availability
LO 8	Student is able to apply and configure some high availability solutions
	In terms of social competence:
LO 9	Student understands the need to constantly acquire knowledge about reliability and high availability of computer system

Course content	
Form of classes – lectures (L)	
	Course content
L1	*Introduction to computer system reliability*
L2	*Theory of reliability and modelling of system reliability*
L3	*Computer system redundancy and robustness*
L4	*Recovery, replication and link aggregation*
L5	*Reliability of network and network services*
L6	*Failover clusters*
L7	*Network load balancing*
L8	*Storage area network*
Form of classes – laboratories (Lab)	
	Course content
Lab1	Modelling of reliability of non-reparable systems
Lab2	Modelling of reliability of reparable systems
Lab3	Calculation of reliability of non-reparable systems
Lab4	Calculation of reliability of reparable systems
Lab5	RAID systems
Lab6	Network load balancing
Lab7	Configuring remote desktop services with redundancy
Lab8	Configuring iSCSI
Lab9	Failover cluster

Required textbooks and other course materials	
1	M. L. Shooman: Reliability of Computer Systems and Networks: Fault Tolerance, Analysis and Design, Wiley, 2002
2	K. S. Trivedi: Probability and Statistics with Reliability, Queuing, and Computer Science Applications, John Wiley and Sons, New York, 2001.
3	B.S. Dhillon, Computer System Reliability Safety and Usability, CRC Press, 2013.
Recommended textbooks and other course materials	
1	Tate, J., Beck, P., Ibarra, H. H., Kumaravel, S., & Miklas, L. (2016). Introduction to storage area networks. IBM Redbooks.

2	R. Shimonski, Windows Server 2003 Clustering & Load Balancing, McGraw-Hill, 2003
3	O. Thomas, Configuring Advanced Windows Server 2012 Services, Mocrosoft Press, 2013

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Module/Course Syllabus
[Name of the field of study]
II - degree programme

Course:	*Fiber optics technology in teleinformatics*
Type of the course:	*Core/Obligatory/Elective*
Course code:	SI05
Year:	I
Semester:	I
Form of the degree programme:	*Full-time/~~Part-time~~*
Form of classes and number of hours per semester:	*60*
Lecture	*30*
Classes	*0*
Laboratory	*30*
Project	*0*
Number of ECTS credits:	*6*
Form of assessment:	*Examination/~~Course completion assessment~~*
Course language:	*English*

Course objective (CO)	
CO1	*Familiarization with structure, parameters and properties of optical fibers.*
CO2	*Familiarization with kinds, parameters and application of optoelectronics elements.*
CO3	*Familiarization with methods of transmission teleinformatics signals.*
CO4	*Acquire the ability to handle fiber optic and fiber optic equipment.*
CO5	*Acquire the ability to determine parameters of optoelectronic components.*
CO6	*Acquiring the skills of self-employment and teamwork in performing activities typical of industrial practice.*

Prerequisites in terms of knowledge, skills and other competencies	
1	Competences acquired after completing Physics

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Knowledge of the construction, parameters and properties of passive and active optoelectronic components.
LO 2	Knowledge of issues related to the use of optical fibers for signal transmission.
	In terms of skills:
LO3	Ability to determine basic parameters of optoelectronic components.

LO4	Ability to use fiber optic and fiber optic equipment.
LO5	Ability to safe operation with optoelectronics components.
	In terms of social competence:
LO6	Can cooperate in a group.

Course content	
Form of classes – lectures (L)	
	Course content
L1	Fiber optic - construction, types, manufacturing methods, parameters and properties.
L2	Fiber optic cables.
L3	Passive elements of optical fiber: connectors, attenuator, couplers, circulators, lenses.
L4	Light sources and detectors.
L5	Active elements of fiber optic lines: fiber optic amplifiers, modulators, switches, filters, multiplexers, wavelength converters.
L6	Methods of determination of fiber parameters: attenuation, numerical aperture, wavelength cutoff.
L7	Fiber optic networks.
L8	Transmission multiplexing techniques.
L9	Fundamentals of designing teleinformatic networks.
Form of classes – laboratories (Lab)	
	Course content
Lab1	OSH training. Determining a numerical aperture.
Lab2	Measurement of optical fiber attenuation.
Lab3	Semiconductor light sources.
Lab4	Features of single mode fiber.
Lab5	Methods of connecting fiber optic cables.
Lab6	Parameters of fiber optic couplers and circulators.
Lab7	Fiber optic link.
Lab8	Study of Bragg fiber optics.
Lab9	Reflectometric measurements.
Lab10	Testing the fiber optic link.

Required textbooks and other course materials	
1	*G.Keiser: Optical Fiber Communications, McGraw-Hill Education (India) Pvt Limited, 2008*
2	D.Derickson: Fiber Optic Test and Measurement, Hewlett-Packard Company 1998
Recommended textbooks and other course materials	
1	*B. Mukherjee: Optical Communication Networks,1998*
2	G. Einarsson: Principles of Lightwave Communications, Wiley, 1996
3	R. J. Hoss, E. A. Lacy: Fiber Optics, Prentice Hall, 1993

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Karta (sylabus) modułu/przedmiotu
Informatyka
Studia II stopnia

Przedmiot:	*Mobilność i multimedia w sieciach IP*
Rodzaj przedmiotu:	*Specjalnościowy*
Kod przedmiotu:	SI10
Rok:	II
Semestr:	III
Forma studiów:	*Studia niestacjonarne*
Rodzaj zajęć i liczba godzin w semestrze:	*14*
Wykład	*14*
Ćwiczenia	*0*
Laboratorium	*14*
Projekt	*0*
Liczba punktów ECTS:	*2*
Sposób zaliczenia:	*Egzamin*
Język wykładowy:	*Język polski*

Cele przedmiotu	
C1	Uzyskanie wiedzy, kompetencji i praktycznych umiejętności w zakresie reprezentacji, generowania, przechowywania i przetwarzania strumieniowych danych multimedialnych oraz mechanizmów ich efektywnej transmisji we współczesnych sieciach komputerowych.
C2	Zaznajomienie z protokołami i mechanizmami wykorzystywanymi także w technologiach mobilnych (IMS).
C3	Uzyskanie wiedzy w zakresu podstaw detekcji problemów i bezpieczeństwa transmisji danych multimedialnych.

Wymagania wstępne w zakresie wiedzy, umiejętności i innych kompetencji	
1	Podstawy sieci komputerowych
2	Podstawy multimediów

Efekty kształcenia	
	W zakresie wiedzy:
EK 1	Student ma podstawową wiedzę na temat prezentacji, generowania, przechowywania i przetwarzania strumieniowych danych multimedialnych oraz mechanizmów ich efektywnej transmisji we współczesnych sieciach komputerowych.
EK 2	Student ma podstawową wiedzę z zakresu technologii mobilnych
	W zakresie umiejętności:
EK 3	Student ma rozszerzoną wiedzę w zakresie protokołów multimedialnych w sieciach IP i podstawowe umiejętności ich konfiguracji
	W zakresie kompetencji społecznych
EK 4	Rozumie potrzebę doskonalenia warsztatu administratora

Treści programowe przedmiotu

Forma zajęć – wykłady		
	Treści programowe	Liczba godzin
W01	Wprowadzenie. Multimedia w sieciach komputerowych i komunikacji. Cele i wyzwania. Przygotowanie sygnału multimedialnego do transportu. Kompresja	2
W02	Podstawy transmisji pakietowej w sieciach IP	2
W03	Specyfika sieci bezprzewodowych (Wireless Networking)	2
W04	Architektury i cechy wybranych rozwiązań transmisji multimedialnych	2
W05	Wybrane kwestie w transmisji danych multimedialnych. Jakość usług QoS. Bezpieczeństwo w transmisji danych multimedialnych.	2
W06	Architektury zdecentralizowane (P2P) a systemy mobilne. Architektury i cechy wybranych rozwiązań transmisji multimedialnych	2
W07	Egzamin zerowy	2
	Suma godzin:	**14**
Forma zajęć – laboratoria		
	Treści programowe	Liczba godzin
L1	BHP oraz omówienie regulaminu i zasad obowiązujących na zajęciach. Zapoznanie się ze sprzętem, konfiguracja i praca w różnych topologiach sieciowych (Ad-Hoc, Infrastruktura, WDS)	2
L2	Podstawy konfiguracji aktywnych urządzeń sieciowych	2
L3	Trasy statyczne i NG	2
L4	DHCP i IPv6	2
L5	Podstawowa konfiguracja systemu VOiP	2
L6	Konfiguracja systemu strumieniowego JetCast / System wymiany treści multimedialnych DLNA	2
L7	Termin odróbkowy / Zaliczenie	2
	Suma godzin:	**14**

Metody dydaktyczne	
1	Wykład / wykład z prezentacją multimedialną
2	Praca w laboratorium
3	Praca w grupach, analiza przypadków

Obciążenie pracą studenta	
Forma aktywności	Średnia liczba godzin na zrealizowanie aktywności
Godziny kontaktowe z wykładowcą, w tym:	*28*
udział w wykładach	*14*
udział w ćwiczeniach laboratoryjnych	*14*
Praca własna studenta, w tym:	

Przygotowanie do ćwiczeń lab. w oparciu o literaturę przedmiotu	*10*
Samodzielne przygotowanie do zaliczenia wykładu	*10*
Łączny czas pracy studenta	*48*
Sumaryczna liczba punktów ECTS dla przedmiotu:	*2*
Liczba punktów ECTS w ramach zajęć o charakterze praktycznym (ćwiczenia, laboratoria, projekty)	*0*

Literatura podstawowa i uzupełniająca	
1	Antosik B.: Transmisja internetowa danych w czasie rzeczywistym, WKŁ 2010
2	Chen C.W., Li Z., Shiguo L.: Intelligent Multimedia Communication: Techniques and Applications, Springer 2010.
3	Chou P.A., van der Schaar M.: Multimedia over IP and Wireless Networks Compression, Networking and Systems, Elsevier 2007.
4	Demetriades G.C.: Streaming Media. Building and Implementing a Complete Streaming System, Wiley Publishing 2003.
5	Estrin D. i in.: Protocol Independent Multicast – Sparse Mode: Protocol Specification, RFC 2362, 1998
6	Fa-Long L.: Mobile Multimedia Broadcasting Standards Technology and Practice, Springer Science+Business Media 2009.
7	Follansbee J.: Get Streaming! Quick Steps to Delivering Audio and Video Online, Elsevier 2004.
8	Gromaszek K., Wójcik W. [Red:].: Sieci komputerowe, Lublin: Komitet Inżynierii Środowiska PAN, 2011, 221 s.

Macierz efektów kształcenia					
Efekt kształcenia	Odniesienie danego efektu kształcenia do efektów zdefiniowanych dla całego programu (PEK)	Cele przedmiotu	Treści programowe	Narzędzia dydaktyczne	Sposób oceny
EK 1	I2A_W03, I2A_W04, I2A_W05,	*[C1, C2, C3]*	*[W1, W3, L4, L5]*	*[1,2, 3]*	*[O1]*
EK 2	I2A_W04, I2A_W05, I2A_W06, I2A_W07,	*[C2, C3]*	*[W1 – W6, L1 – L6]*	*[1,2, 3]*	*[O1]*
EK 3	I2A_W05, I2A_W06, I2A_W07, I2A_W09,	*[C3, C4]*	*[W1 – W6, L1 – L6]*	*[1,2, 3]*	*[O1]*
EK 4	I2A_K01, I2A_K02	*[C3, C4]*	*[W1 – W6, L1 – L6]*	*[1,2, 3]*	*[O1]*

Metody i kryteria oceny		
Symbol metody oceny	Opis metody oceny	Próg zaliczeniowy
O1	*Egzamin pisemny*	*50%*

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Adres e-mail:	k.gromaszek@pollub.pl
Jednostka organizacyjna:	Wydział Elektrotechniki i Informatyki, Instytut Elektroniki i Technik Informacyjnych, Zakład Diagnostyki i Analizy Pomiarów

Module/Course Syllabus

[Name of the field of study]

2nd- degree programme

Course:	*Name of the course*
Type of the course:	*Core/Obligatory/Elective*
Course code:	SI18
Year:	II
Semester:	III
Form of the degree programme:	*Full-time*
Form of classes and number of hours per semester:	*45*
Lecture	
Classes	*15*
Laboratory	
Project	*30*
Number of ECTS credits:	*20*
Form of assessment:	*Course completion assessment*
Course language:	*English*

Course objective (CO)	
CO1	*Understanding the requirements for writing a master thesis*
CO2	*Evolving skills for information gathering and its creative processing aiming to develop a dissertation.*
CO3	*Gaining and mastering skills for master thesis presentation.*
CO4	*Increasing skills for IT problems solving, including applications development.*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Completing of a 1st degree programme*
2	
…	

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	*The student knows and understands the basic concepts and principles of industrial property and copyright protection and the need to manage intellectual property resources; can use the patent information resources.*
	In terms of skills:
LO 2	*The student can obtain information from literature, databases and other resources also in English; He/She can integrate the information obtained, interpret and evaluate it, draw conclusions and both formulate and justify the opinions.*

LO 3	*The student can prepare and present a presentation in English on the subject of the project or research task appropriate to the field of computer science.*
LO 4	*The student can prepare and lead a discussion on the presented presentation in Polish and foreign language on specific issues in the field of computer science.*
LO 5	*The student can plan and conduct experiments, including measurements, computer simulations, interpret the results and draw the proper conclusions.*
LO 6	*The student can suggest an improvement in an operating software or a device.*
LO 7	*The student can assess the usefulness of the research methods, design patterns, technologies and tools to solve complex (also untypical or research) problems in the field of Computer Science; is aware of the limitations of these methods and tools.*
	In terms of social competence:
LO 6	*The student is able to interact and work in a group, playing the different roles in it.*
LO 7	*The student is aware of the role of a technical college graduate, especially understands the need to formulate and communicate to the public, in particular through the mass media, information and opinions on technical achievements and other aspects of engineering activities; It shall endeavor to convey such information and opinions in a generally understandable manner, justifying the various points of view.*

Course content	
Form of classes – lectures (L)	
	Course content
L1	*n.a.*
L2	*n.a.*
Form of classes – classes (C)	
	Course content
C1	*Demonstration of the requirements for completing the course. Talk about selected topics of work. Presentation of formal requirements for master's theses.*
C2	
C3	*A detailed discussion of the structure of the thesis and references to the literature sources.*
C4	
C5	*Presentation of issues concerning the presentation of diploma theses using the multimedia techniques.*
C6	
C7	*Preliminary presentation of the theses, scope and purpose of the work with the use of multimedia presentations by the students; discussion.*
C8	
C9	*Preliminary presentation of the theses, scope and purpose of the work with the use of multimedia presentations by the students; discussion (cont.).*
C10	
C11	*Presentation of summaries, conclusions and abstracts of the master theses. Discussion of the presented topics.*
C12	
C13	*Presenting of the students' master theses; discussions.*
C14	
C15	*Obtaining the credit*
Form of classes – laboratories (Lab)	
	Course content

Lab1	*n.a.*
Lab2	*n.a.*
Form of classes – project (P)	
	Course content
P1	*Introductory information, requirements for obtaining the credit. Discussing the design topics.*
P2	*Assigning topics to students or student teams. Overview of the scope of the project.*
P3	*Presenting a literature review on the topic of the project.*
P4	
P5	*Presentation of students' choice of IT tools to solve the project assigned, discussion.*
P6	*Presentation and discussion of the initial concept of the project solution, discussion.*
P7	
P8	*The design work, presentation of progress, discussion.*
P9	
P10	
P11	*Testing and improvement.*
P12	*Preparation of a multimedia presentation on the project.*
P13	
P14	*Obtaining the credit - final presentation of the project using the multimedia presentation.*
P15	

Required textbooks and other course materials	
1	*Guidelines for thesis preparation at LUT*
2	
…	
Recommended textbooks and other course materials	
1	*Murugappan P., Mastering Presentation Skills Using Microsoft Powerpoint, Blue Micro Solutions, 2015*
2	*Koegel T.J., The Exceptional Presenter: A Proven Formula to Open Up and Own the Room, Greenleaf Book Group, 2007*
3	*Stuart C., Speak for Yourself, Judy Piatkus (Publishers) Ltd., 2000*

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Organisational unit:	Institute of Electronics and Information Technology

Module/Course Syllabus
[Name of the field of study]
2nd- degree programme

Course:	*Name of the course*
Type of the course:	*Core/Obligatory/Elective*
Course code:	SI18
Year:	II
Semester:	III
Form of the degree programme:	*Part-time*
Form of classes and number of hours per semester:	*21*
Lecture	
Classes	*7*
Laboratory	
Project	*14*
Number of ECTS credits:	*20*
Form of assessment:	*Course completion assessment*
Course language:	*English*

Course objective (CO)	
CO1	*Understanding the requirements for writing a master thesis*
CO2	*Evolving skills for information gathering and its creative processing aiming to develop a dissertation.*
CO3	*Gaining and mastering skills for master thesis presentation.*
CO4	*Increasing skills for IT problems solving, including applications development.*

Prerequisites in terms of knowledge, skills and other competencies	
1	*Completing of a 1st degree programme*
2	
…	

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	*The student knows and understands the basic concepts and principles of industrial property and copyright protection and the need to manage intellectual property resources; can use the patent information resources.*
	In terms of skills:

LO 2	*The student can obtain information from literature, databases and other resources also in English; He/She can integrate the information obtained, interpret and evaluate it, draw conclusions and both formulate and justify the opinions.*
LO 3	*The student can prepare and present a presentation in English on the subject of the project or research task appropriate to the field of computer science.*
LO 4	*The student can prepare and lead a discussion on the presented presentation in Polish and foreign language on specific issues in the field of computer science.*
LO 5	*The student can plan and conduct experiments, including measurements, computer simulations, interpret the results and draw the proper conclusions.*
LO 6	*The student can suggest an improvement in an operating software or a device.*
LO 7	*The student can assess the usefulness of the research methods, design patterns, technologies and tools to solve complex (also untypical or research) problems in the field of Computer Science; is aware of the limitations of these methods and tools.*
	In terms of social competence:
LO 6	*The student is able to interact and work in a group, playing the different roles in it.*
LO 7	*The student is aware of the role of a technical college graduate, especially understands the need to formulate and communicate to the public, in particular through the mass media, information and opinions on technical achievements and other aspects of engineering activities; It shall endeavor to convey such information and opinions in a generally understandable manner, justifying the various points of view.*

Course content	
Form of classes – lectures (L)	
	Course content
L1	*n.a.*
L2	*n.a.*
Form of classes – classes (C)	
	Course content
C1	*Demonstration of the requirements for completing the course. Talk about selected topics of work. Presentation of formal requirements for master's theses.*
C2	
C3	*A detailed discussion of the structure of the thesis and references to the literature sources.*
C4	
C5	*Presentation of issues concerning the presentation of diploma theses using the multimedia techniques.*
C6	
C7	*Preliminary presentation of the theses, scope and purpose of the work with the use of multimedia presentations by the students; discussion.*
C8	
C9	*Preliminary presentation of the theses, scope and purpose of the work with the use of multimedia presentations by the students; discussion (cont.).*
C10	
C11	*Presentation of summaries, conclusions and abstracts of the master theses. Discussion of the presented topics.*
C12	
C13	*Presenting of the students' master theses; discussions.*
C14	

C15	*Obtaining the credit*
Form of classes – laboratories (Lab)	
	Course content
Lab1	*n.a.*
Lab2	*n.a.*
Form of classes – project (P)	
	Course content
P1	*Introductory information, requirements for obtaining the credit. Discussing the design topics.*
P2	*Assigning topics to students or student teams. Overview of the scope of the project.*
P3	*Presenting a literature review on the topic of the project.*
P4	
P5	*Presentation of students' choice of IT tools to solve the project assigned, discussion.*
P6	*Presentation and discussion of the initial concept of the project solution, discussion.*
P7	
P8	*The design work, presentation of progress, discussion.*
P9	
P10	
P11	*Testing and improvement.*
P12	*Preparation of a multimedia presentation on the project.*
P13	
P14	*Obtaining the credit - final presentation of the project using the multimedia presentation.*
P15	

Required textbooks and other course materials	
1	*Guidelines for thesis preparation at LUT*
2	
…	
Recommended textbooks and other course materials	
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2	*Koegel T.J., The Exceptional Presenter: A Proven Formula to Open Up and Own the Room, Greenleaf Book Group, 2007*
3	*Stuart C., Speak for Yourself, Judy Piatkus (Publishers) Ltd., 2000*

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Organisational unit:	Institute of Electronics and Information Technology

logo wydziału

Module/Course Syllabus
[Name of the field of study]
Master of Science - degree programme

Course:	Mobile and Wireless Communication Systems
Type of the course:	Obligatory
Course code:	
Year:	1
Semester:	Summer
Form of the degree programme:	Full-time
Form of classes and number of hours per semester:	60
Lecture	30
Classes	-
Laboratory	30
Project	-
Number of ECTS credits:	5
Form of assessment:	Examination
Course language:	English

Course objective (CO)	
CO1	Make students acquainted with basics of radio communication, architectures and technical standards of mobile and wireless communication networks
CO2	Educate students to select devices or sub-systems with functional characteristics adequate to fulfil requirements of particular applications of mobile or wireless communication
CO…	Rise student awareness that radio systems utilize drainable spectrum resources

Prerequisites in terms of knowledge, skills and other competencies	
1	Mathematics
2	Signal theory
3	Fundamentals of telecommunications

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	Knows limitations of digital mobile and wireless communications resulting from specific properties of working environment and limitations given by information theory
LO 2	Can recognize and distinguish particular mobile and wireless communication systems and can describe their functional characteristics
LO 3	Can explain architecture of the GSM system, the role of inteligent networks and databases in mobile systems and can explain the role of IP protocol in mobile communication
	In terms of skills:

LO4	Can select adequate type of modulation, error protection scheme and a communication sub-system in the context of known application and environmental characteristics
LO5	Can propose and arrange an adequate measurement set-up for assesment of technical characteristics of a wireless communication device/sub-system and can make related measurements
LO6	Can make use of functional characteristics of wireless devices/systems in order to set up communication with presumed features
	In terms of social competence:
LO7	Is conscious of the need for effective utilization of radio resources
LO8	Appreciates the necessity of lifetime learning

Course content	
Form of classes – lectures (L)	
	Course content
L1	Terrestial radio-communication systems. Radio spectrum utilization. Cellular structures.
L2	Effective utilization of radio resources. Multiple access methods.
L3	Properties of mobile communication channel
L4	Mitigation of adverse characteristics of mobile channel. Digital modulations, channel correction, adaptation. Forward error coding and ARQ scheme.
L5	Protocols for radio link access. Hidden, exposed terminal problems. Techniques supporting quality of transmission.
L6	Network layer of mobile systems. Mobile IP.
L7	GSM architecture and operation basics. Intelligent network and telecommunication data bases.
L8	GSM radio interface. Physical and logical channels. Transmission plans.
L9	Data transmission in cellular networks
L10	Wireless access networks – concepts and standards. Local and wide-area wireless networks.
L11	Next generations in mobile communication. Future trends.
Form of classes – classes (C)	
	Course content
C1	-
C2	-
Form of classes – laboratories (Lab)	
	Course content
Lab1	Susceptability of binary phase and frequency modulations to interference in mobile communication channel
Lab2	Susceptability of multilevel single carrier modulations to interference in mobile communication channel
Lab3	Susceptability of OFDM modulation scheme to interference in mobile communication channel
Lab4	Effectivity of FEC usage in mobile channel
Lab5	Application of the ARQ algorithm. Adaptation of transmission frame length.
Lab6	Features of CDMA multiple access technique
Lab7	Throughput of the 802.11 network

Lab8	Roaming in the 802.11 network
Lab9	VoIP communication in the 802.11 network
Form of classes – project (P)	
	Course content
P1	-
P2	-

Required textbooks and other course materials	
1	A. Goldsmith, Wireless networks, Cambridge University Press, 2005
2	S. Haykin, Communications Systems, Willey, 2001
Recommended textbooks and other course materials	
1	J. Eberspächer, H-J Vögel, C. Bettstetter, C. Hartmann, GSM - Architecture, Protocols and Services, Willey, 2009

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