

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Computer networks</b>		Code <b>1010331441010334959</b>
Field of study <b>Information Engineering</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>2 / 4</b>
Elective path/specialty <b>-</b>	Subject offered in: <b>polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>First-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>3</b> Classes: <b>-</b> Laboratory: <b>2</b> Project/seminars: <b>-</b>		No. of credits <b>6</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b>		ECTS distribution (number and %) <b>6 100%</b>
<b>Responsible for subject / lecturer:</b>  dr inż. Andrzej Szwabe email: Andrzej.Szwabe@put.poznan.pl tel. 61 665 3958 Wydział Elektryczny ul. Piotrowo 3A 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
<b>1</b>	<b>Knowledge</b>	K_W02: Student has basic knowledge of physics, especially in such fields as mechanics, thermodynamics, optics, electricity, magnetism, nuclear physics, solid-state physics, including knowledge essential to understand physical phenomena in electronic circuits.  K_W05: Student has organized knowledge with theoretical foundations of basic program constructions, algorithm implementations, paradigms and programming styles, software verification methods, formal languages, compilers, platforms.
<b>2</b>	<b>Skills</b>	K_U01: Student is able to acquire information from literature, data bases and other sources; student is able to integrate acquired information, to interpret it, to draw conclusions and to formulate and justify judgments.  K_U03: Student is able to create engineer work documentation and to prepare text with the work result discussion.  K_U10: Student is able to use software platforms and environments for simple programs encoding, running and testing in programming languages.
<b>3</b>	<b>Social competencies</b>	K_K02: Student understands and is aware of the importance of nontechnical issues related to computer engineer activity. Student understands the responsibility associated to his engineering decisions.
<b>Assumptions and objectives of the course:</b>  The main objective of the course is to present advanced network technologies - not only those already widely used in computer networks, but also those that have recently gained popularity as potentially effective solutions to already identified problems to be faced by so-called Future Internet. In particular, the course provides knowledge in the area of new wireless network technologies, including wireless mesh, mobile ad-hoc networks (MANET) and wireless multi-hop networks (large networks without or with little fixed infrastructure), as well as technologies enabling effective operation of multi-service heterogeneous networks, in particular dynamic routing protocols, social collaboration and fairness enforcement frameworks, Quality of Service (QoS) management techniques.		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
1. Student has organized knowledge with theoretical foundations of computer networks. - [K_W07] 2. Student has organized knowledge with theoretical foundations of Internet technologies. - [K_W11] 3. Student has organized knowledge with theoretical foundations of teleinformatics, protocols and services in telecommunication networks. - [K_W15]		
<b>Skills:</b>		

1. Student is able to do critical analysis of computer hardware operations, operating system and computer networks. - [K_U11]
2. Student is able to carry out work with web sites and Internet services. - [K_U15]
<b>Social competencies:</b>
1. Student understands and is aware of the importance of nontechnical issues related to computer engineer activity. Student understands the responsibility associated to his engineering decisions. - [K_K02]

<b>Assessment methods of study outcomes</b>
Lecture: final exam. Laboratory: tests before exercises, exercises assesment, reports assesment. More than 50% points are necessary for positive result.
<b>Course description</b>
The topics of the course include: <ul style="list-style-type: none"> <li>- Distributed and semi-distributed queuing management techniques for IP networks</li> <li>- Quality of Service (QoS) management techniques</li> <li>- Fully dynamic routing (including Optimized Link-State Routing)</li> <li>- Network-layer resource optimization techniques (multi-path routing and its influence on QoS, Max Weight Scheduling technique, backpressure principle, IntServ and DiffServ models, RSVP protocol)</li> <li>- Effectiveness of transport-layer protocols (new versions of TCP: Reno2, Vegas, FAST, TCP delayed reordering technique)</li> <li>- Network resource optimisation from application-layer perspective (differences between file transmission and audiovisual streaming, TCP flow control vs UDP/RTP+RTCP flow control, adaptive streaming, application-layer flow control)</li> <li>- Various fairness models (reverse engineering of TCP utility, delay-aware Network Utility Maximization, multi-service fairness)</li> <li>- Interdependence of transport-layer and network-layer functions and protocols</li> <li>- Cross-layer network functions and protocols optimisation, interdependence of MAC-sublayer algorithm and queuing management in fixed and wireless networks</li> <li>- IP network operation stability</li> <li>- Design and implementation of network protocol stacks</li> <li>- New types of wireless networks (wireless mesh networks, mobile ad-hoc networks (MANET), wireless multi-hop networks, heterogeneous networks, fully dynamic routing in wireless multi-hop networks, Optimized Link-State Routing)</li> <li>- Selected important research activities conducted in EU and USA in the area of Future Internet technologies</li> </ul> Topics of laboratory exercises: <ol style="list-style-type: none"> <li>1. Network services configuration</li> <li>2. Protocol implementation in MIT Click Modular Router environment</li> <li>3. Static routing in a multi-path network</li> <li>4. Dynamic routing - RIP protocol</li> <li>5. Dynamic routing - OSPF protocol</li> <li>6. Multicast addressing and routing - PIM-SM protocol</li> <li>7. Effectiveness of TCP - configuration of logical connection</li> <li>8. Effectiveness of TCP - flow control optimisation</li> <li>9. Quality of UDP transmission: QoS parameters, comparison to TCP</li> <li>10. Text-based application-layer protocols - Telnet, FTP</li> <li>11. HTTP protocol, virtual sessions</li> <li>12. DNS system</li> <li>13. Transport protocols for audiovisual streaming systems (RTP, RTCP)</li> <li>14. Session setup and control protocols for 3G systems (SIP, RTSP)</li> <li>15. Advanced firewall with QoS functionalities</li> <li>16. SOAP protocol for inter-application communication</li> </ol>
<b>Basic bibliography:</b>
1. Sieci komputerowe i intersieci, D.E. Comer, WNT, Warszawa, 2001 2. Sieci komputerowe, A. Tanenbaum, Helion, Gliwice, 2004

<b>Additional bibliography:</b>		
1. The Internet And Its Protocols, A Comparative Approach, Adrain Farrel, Morgan Kaufmann, Elsevier, San Francisco, 2004		
<b>Result of average student's workload</b>		
<b>Activity</b>	<b>Time (working hours)</b>	
1. Lectures	45	
2. Laboratory	30	
3. Consultations and exam	10	
4. Preparation for laboratory	35	
5. Laboratory reports preparation and exam preparation	30	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	150	6
Contact hours	75	3
Practical activities	75	3