



## Subject card

Subject name and code	Engineering of Access and Core Systems, PG_00048154						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2026/2027		
Education level	first-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	4	Language of instruction			Polish		
Semester of study	7	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Teleinformation Networks -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Lech Smoleński					
	Teachers	dr inż. Lech Smoleński					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours		Self-study		SUM
	Number of study hours	45	3.0		27.0		75
Subject objectives	Transfer of theoretical and practical knowledge concerning the operation of telecommunications systems in the area of access and core networks, including techniques and equipment, used in the optical transmission WDM, methods protection of transmission, standardization of optical transport network OTN and transmission systems used in access networks for the realization of fixed broadband access, using copper lines, symmetrical or coaxial, fiber optics and radio transmission as well as the functioning of the IP routers with QoS and principles of software switching in a VoIP networks.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U31] can identify telecommunications network architectures, differentiates their areas and functional elements, evaluates the quality of service delivery, calculates parameters of functional elements	Student is able to identify telecommunications network architectures, distinguishes their areas and functional elements, assesses the quality of services provided by networks, calculates the parameters of functional elements in the access and core network			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	Students evaluate the standard systems used in the area of access and core network with the quality of services, analyzing the use of standardized transmission systems in access network is able to offer the correct configuration of the optical transport network			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_W35] Knows the concepts of the technique of signal transmission, operation of telecommunications networks and multimedia services and the rules for providing them	Student describes the principles of operation of optical transport network, knows the standard for transmission systems in access networks, explains transmission security techniques, defines the factors affecting the quality of service QoS			[SW1] Assessment of factual knowledge		

Subject contents	<ol style="list-style-type: none"> <li>1. Specifics of communications networks areas – core, distribution, access</li> <li>2. DWDM optical transmissions systems, elements of optical link</li> <li>3. Amplifying and regeneration of signals on DWDM optical line transmission systems</li> <li>4. Multiplexing equipment (OMUX. OADM) in optical network</li> <li>5. Optical cross-connects (OXC) in optical network</li> <li>6. Transmission protection methods for DWDM optical networks</li> <li>7. Reconfiguration and restoration in DWDM optical networks</li> <li>8. Optical transport network (OTN) – structure and standardization</li> <li>9. Digital wrapper in OTN, optical channels OCh, optical multiplexing OMS, optical transport OTS</li> <li>10. Interfaces and tributary signals in OTN optical layer</li> <li>11. Ethernet in optical transport network (OTN)</li> <li>12. SDH systems in optical networks</li> <li>13. Generic framing procedure (GFP)</li> <li>14. Method of transmission rate adaptation, LCAS protocol</li> <li>15. Functions and structure of broadband access networks</li> <li>16. Optical access on PON – E-PON and G-PON standards</li> <li>17. ADSL broadband access systems – generations of standard</li> <li>18. VDSL broadband access systems –standards</li> <li>19. Ethernet on access network with A/VDSL systems</li> <li>20. Broadband access on HFC networks – standards</li> <li>21. Fixed broadband radio access</li> <li>22. Broadband distribution services in access networks</li> <li>23. QoS in broadband access networks</li> <li>24. Evolution of hardware IP routers architecture</li> <li>25. The structure and operation of the IP QoS router</li> <li>26. Review of IP QoS routers solutions</li> <li>27. Realization of MPLS nodes</li> <li>28. Comparison of applied MPLS nodes</li> <li>29. Architecture of Softswitch</li> <li>30. Review of Softswitch solutions</li> <li>31. Architecture of media and signaling gateways</li> <li>32. Solutions review of media and signaling gateways</li> <li>33. Corporate switching nodes with VoIP</li> </ol>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Subject passing criteria</th> <th style="width: 33%;">Passing threshold</th> <th style="width: 34%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Midterm colloquium</td> <td>50.0%</td> <td>60.0%</td> </tr> <tr> <td>Practical exercise</td> <td>50.0%</td> <td>40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Midterm colloquium	50.0%	60.0%	Practical exercise	50.0%	40.0%
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Example issues/ example questions/ tasks being completed	Configuration of data transport in WDM systems Protection mechanisms for data transport in WDM systems ADSL systems in the access network VDSL systems in the access network Configuration and monitoring passive optical network GEAPON Implementation of multimedia services in the broadband access network											
Work placement	Not applicable											