



Subject card

Subject name and code	Wireless Sensor Networks, PG_00064013						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2027/2028		
Education level	second-cycle studies	Subject group			Optional subject group Specialty 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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Metrology and Electronic Systems Department -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Zbigniew Czaja					
	Teachers	dr hab. inż. Zbigniew Czaja					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	30
	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	30		3.0		42.0	75
Subject objectives	Understanding the basis of the design, operation and control of telemetric distributed networks.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student lists the components of the TSR, describes the protocol stack of TCP / IP microservers, characterizes the construction and operation of TCP / IP microservers.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
	[K7_U07] can apply advanced methods of process and function support, specific to the field of study	Student lists the components of the TSR, describes the protocol stack of TCP / IP microservers, characterizes the construction and operation of TCP / IP microservers.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
	[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student defines telemetric distributed systems (TSR), characterizes applications and TSR requirements, describes the layers of TSR protocols.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	Student defines telemetric distributed systems (TSR), characterizes applications and TSR requirements, describes the layers of TSR protocols.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation	
Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. Introduction, plan of the lecture, definition of the Telemetric Distributed Systems (TDS). 2. Characteristics, fields of applications and requirements for TDS. 3. Standards : IEEE 1451, IEEE 802.15, ZigBee. 4. Specifics of star, peer-to-peer, cluster-tree topologies for TDS networks. 5. Components of TDS networks: coordinator with Ethernet gateway, coordinator with the router function, full function device, reduced function device. 6. Architecture of ending devices (nodes) of TDS networks (power, sensing, computing and communication subsystems). 7. TDS protocol stack for nodes (physical, data link, network, transport and application layers). 8. MAC layer of the TDS protocol stack. 9. Routing protocols in TDS networks (requirements, classifications, operation principles). 10. Approaches of the Middleware Layer for TDS nodes. 11. Application Layer – controlling of sensors and preliminary processing of measurement data. 12. Parameters defining of QoS (Quality of Services) for TSR: throughput, reliability, security, mobility, latency, data accuracy in relation to energy usage. 13. Security in TSR networks. Robustness against passive and active attacks. Security in standards: IEEE 802.15.4 and ZigBee. 14. Construction of the coordinator with the Ethernet gateway. 15. Advantages of connection of TSR networks to Internet. 16. Minimal TCP/IP stack for microservers serving function of the coordinator with the Ethernet gateway. 17. Hardware realizations of TCP/IP microservers in TDS. 18. Specific of the Ethernet Layer in TCP/IP microservers. 19. Implementation of ARP and IP protocols in TCP/IP microservers. 20. Adaptation of ICMP and TCP protocols for computing power of control units controlling TCP/IP microservers. 21. Application Layer controlling TSR on the example of the HTTP protocol. 		
Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written examination	50.0%	100.0%
Recommended reading	Basic literature	Czaja Z.: Telemetric distributed systems – materiały do wykładu, http://www.pg.gda.pl/~zbczaja , Gdańsk 2009. Kuorilehto M., Kohvakka M.: Ultra-low energy wireless sensor networks in practice, Wyd. John Wiley & Sons, Ltd., 2007.	
	Supplementary literature	Eady F.: Hands-on ZigBee. Implementing 802.15.4 with microcontrollers, Wyd. Elsevier, 2007.	
	eResources addresses		

Example issues/ example questions/ tasks being completed	
Practical activities within the subject	Not applicable

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