GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	IT2 - IoT and Cloud Computing Solutions and Services , PG_00066984						
Field of study	Smart Renewable Energy Engineering						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
Education level	second-cycle studies		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	English			
Semester of study	3		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Computer Communications -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Artur Tomaszewski					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	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		4.0	16.0	50	
Subject objectives	*Learn the Internet of Things concept and the IoT systems requirements, architecture, and technologies; operation and organization principles and the characteristics of modern computer networks; technologies and services of computing clouds, including the aspects of performance, reliability, and security.* *Learn the application of IoT, network, and cloud solutions for acquisition and processing of data in sensor-intensive environments, and for control and management of industrial processes.* *The lecture will define main notions, explain basic concepts, provide a general view of systems architecture, and explain solutions characteristics and applications. The demonstrations and own experiments will provide intuition concerning principal features and functioning of major technologies and solutions elements.*						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U02] is capable of creating and analyzing digital models of renewable energy systems, including wind power systems, and utilizes digital tools for project analysis, evaluation, supervision, and optimization	Can apply IoT, network and cloud technologies for acquisition and analysis of data and for development of digital-twins models in the renewable energy sector	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K7_W03] understands the concept of digital twin technology and its application in optimizing and monitoring energy systems using artificial intelligence methods and large-scale data analytics	Knows the characteristics and architecture of IoT, computer networks, and cloud computing solutions of acquisition and processing of data for digital-twin models supporting monitoring and optimization of renewable energy systems	[SW1] Assessment of factual knowledge
[K7_K03] has intercultural communication competencies, essential for international energy projects, and can collaborate effectively with individuals from various cultures and backgrounds, appreciating diversity	Is capable to search for and analyze current literature on the application of IoT systems, computer networks, and computing clouds in the renewable energy sector, and present the results of the analysis in the international and intercultural environment of energy projects	[SK4] Assessment of communication skills, including language correctness
[K7_W02] knows and understands the challenges of effectively integrating decentralized renewable energy generation into the power grid, including energy storage issues, and is particularly familiar with technologies used in wind power	Knows characteristics, operation principles, architecture, and major technologies of IoT, network, and cloud systems, and their application for acquisition and integration of distributed data, e.g., in the renewable energy and electricity storage systems	[SW1] Assessment of factual knowledge

Subject contents

Computer services and applications. The client-service model. Communications protocols. Application protocols and application data transport protocols. Hands-on experiments with Web applications. (3)

Cloud computing principles. Hardware-level virtualization. Hands-on experiments with virtual machines management. Operating system-level virtualization. Containers, container repositories, and container engine and container orchestration platforms. Cloud service classes. Hands-on experiments with system composition and orchestration. (6)

Service-oriented system architecture. The microservices model. Agile principles of system development and deployment; continuous development, integration, delivery, and deployment processes. Design patterns of cloud applications. (2)

Operation and architecture principles of computer networks. Packet switching; principles, features, and mechanisms. Network protocols. (3)

The Internet of Things concept. Characteristics of IoT nodes; sensors and actuators. IoT systems architecture. Specific application protocols. IoT areas, services and applications. Hands-on experiments with connecting IoT devices, data acquisition and device control. (6)

Computer networks organization; backbone network, access network, global and edge clouds (public, private and hybrid). Fibre and wireless access and local area networks, their solutions, technologies, characteristics. (2)

5G networks. Use-case classes. Service characteristics and requirements. Service verticals. Private 5G networks. Hands-on experiments with connecting 5G devices. (6)

Performance, reliability and security of networks and services. Threats and attacks. Security mechanisms and policies. Good practices. (2)

Prerequisites and co-requisites

Solid knowledge of object-oriented programming, knowledge of Linux and Windows operating systems, knowledge of computer network basics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written exam	50.0%	100.0%

Recommended reading	Basic literature	1. *Larry Peterson and Bruce Davie: Computer Networks: A Systems Approach, The Morgan Kaufmann Series in Networking, Morgan Kaufmann, sixth edition, 2021* 2. *Larry Peterson, Oguz Sunay, and Bruce Davie: Private 5G: A Systems Approach, Systems Approach, LLC, 2023* 3. *Samuel Greengard: The Internet of Things, Essential Knowledge Series, The MIT Press, revised and updated edition, 2021* 4. *Sam Newman: Building Microservices: Designing Fine-Grained Systems, O'Reilly Media, second edition, 2021*
	Supplementary literature	1. *Jonah Andersson: Learning Microsoft Azure: Cloud Computing and Development Fundamentals, O'Reilly Media, 2023* 2. *Nigel Poulton: The Kubernetes Book, Nielsen Book Services, revised and updated edition, 2024* 3. *Colin Dow: Internet of Things Programming Projects, Packt Publishing, second edition, 2024*
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Characteristics, technologies, and architecture of 5G mobile networks; support for Internet of Things systems. 2. Technologies and platforms for system virtualization; features and models of cloud computing. 3. Service-oriented architecture and microservices model of systems; principles of agile development and system implementation. 4. Characteristics of Internet of Things nodes; architecture of IoT systems.	
Work placement	Not applicable	

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