



## Subject card

|   |   |  |                                     |            |  |         |     |
|---|---|--|-------------------------------------|------------|--|---------|-----|
| Subject name and code                       | Internet and distributed systems, PG_00053373   |  |                                     |            |  |         |     |
| Field of study                              | Biomedical Engineering, Biomedical Engineering, Biomedical Engineering  |  |                                     |            |  |         |     |
| Date of commencement of studies             | February 2023   | Academic year of realisation of subject                      |                                     |            | 2023/2024  |         |     |
| Education level                             | second-cycle studies  | Subject group  |                                     |            | Optional subject group<br>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                               | 1   | Language of instruction                                      |                                     |            | Polish   |         |     |
| Semester of study                           | 2   | ECTS credits   |                                     |            | 2.0  |         |     |
| Learning profile                            | general academic profile  | Assessment form  |                                     |            | assessment   |         |     |
| Conducting unit                             | Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics  |  |                                     |            |  |         |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor  | dr hab. inż. Mariusz Kaczmarek                               |                                     |            |  |         |     |
|   | Teachers  | mgr inż. Natalia Kowalczyk<br>dr hab. inż. Mariusz Kaczmarek |                                     |            |  |         |     |
| Lesson types and methods of instruction     | Lesson type   | Lecture  | Tutorial                            | Laboratory | Project  | Seminar | SUM |
|   | Number of study hours   | 15.0   | 0.0                                 | 15.0       | 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   | 2.0                                 |            | 18.0   | 50      |     |
| Subject objectives                          | The aim of the course is to familiarize students with Internet technologies and methods of distributed processing in the cloud of data from health support and health monitoring systems. One-dimensional and two-dimensional data (images) and image sequences are taken into account. The principles of designing and programming distributed services in selected architectures are discussed. |  |                                     |            |  |         |     |

|   |  |   |   |
|---|--|---|---|
| Learning outcomes   | Course outcome   | Subject outcome   | Method of verification  |
|   | [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.   | The student understands the principles of operation of content exchange systems between client devices and remote servers.  | [SW1] Assessment of factual knowledge   |
|   | [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  | Is able to implement an IT project based on defined functional and non-functional requirements.   | [SU1] Assessment of task fulfilment<br>[SU4] Assessment of ability to use methods and tools |
|   | [K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices   | Is able to design and implement an algorithm for establishing connections and exchanging requests in the client-server (agent-manager) model in a selected programming language.  | [SW3] Assessment of knowledge contained in written work and projects                        |
| [K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions | Is able to analyze the algorithm diagram and is able to interpret/ modify the application source code  | [SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools  |   |
| Subject contents  | <p>Internet distributed systems - definitions, basic concepts, base services in distributed systems<br/> Features of distributed systems. Requirements for distributed systems (including communication, synchronization and data exchange in distributed systems, data consistency models in SR)<br/> Architectures of distributed processing systems (client-server, multi-node systems).<br/> Data reconstruction in distributed systems and distributed transactions<br/> Modern programming languages for implementing Internet and distributed systems (e.g. Python, libraries, JavaScript, etc.)<br/> Distributed processing in web systems (including multi-threaded and parallel processing, e.g. Python multiprocessing, multithreading)<br/> Distributed processing in web systems (including REST, remote implementation of machine learning tasks, e.g. JavaScript vs. Python/TensorFlow)<br/> Development of computationally intensive applications in distributed environments (e.g. HPC clusters; MPI standard, Apache Spark, etc.)</p> <p>Lab<br/> Practical use of distributed processing system architectures (client-server, multi-node systems, TCP vs. UDP, etc.)<br/> Practical implementation of distributed processing in web systems using multi-threaded, parallel processing.<br/> Practical implementation of distributed processing in web systems using remote method calling technology (e.g. REST)<br/> Practical implementation of distributed processing in the implementation of machine learning tasks (e.g. Python, TensorFlow, JavaScript)<br/> Practical implementation of an Internet system in the field of medical services</p> |   |   |
| Prerequisites and co-requisites   | Programming skills in any language, e.g. C++, Python.  |   |   |
| Assessment methods and criteria   | Subject passing criteria   | Passing threshold   | Percentage of the final grade   |
|   | Practice work  | 51.0%   | 60.0%   |
|   | Own work - study   | 51.0%   | 20.0%   |
|   | test   | 51.0%   | 20.0%   |
| Recommended reading   | Basic literature   | <ol style="list-style-type: none"> <li>1. Distributed Systems: Principles and Paradigms 2nd Edition, , <a href="#">Andrew S. Tanenbaum</a>, <a href="#">Maarten van Steen</a>, ISBN: 978-1530281756</li> <li>2. INTERNET COMPUTING: PRINCIPLES OF DISTRIBUTED SYSTEMS AND EMERGING INTERNET-BASED TECHNOLOGIES, Ali Sunyaev, Springer, 2020, ISBN: 9783030349561</li> </ol> |   |

|  |                          |  |
|--|--------------------------|--|
|  | Supplementary literature | <ol style="list-style-type: none"> <li>1. M. Ben-Ari, "Podstawy programowania współbieżnego i rozproszonego", WNT 2009.</li> <li>2. Dokumentacja języka Python (<a href="http://www.python.org">www.python.org</a>).</li> <li>3. Dokumentacja frameworka Django (<a href="http://www.djangoproject.com">http://www.djangoproject.com</a>).</li> <li>4. Dokumentacja biblioteki Wt (<a href="http://www.webtoolkit.eu/wt">http://www.webtoolkit.eu/wt</a>)</li> </ol> |
|  | eResources addresses     | <p>Podstawowe</p> <p><a href="https://ieeexplore.ieee.org/Xplore/home.jsp">https://ieeexplore.ieee.org/Xplore/home.jsp</a> - Database of full-text articles - conference and published in IEEE journals.</p> <p>Adresy na platformie eNauczanie:</p>   |
| Example issues/<br>example questions/<br>tasks being completed |                          |  |
| Work placement   | Not applicable           |  |