

**Module / course (syllabus) card**  
**Field of study: Computer Science**  
 Full-time master's studies

<b>Course:</b>	<b>Web application programming in JEE</b>
<b>Type of course:</b>	<i>elective</i>
<b>Code of course:</b>	I2S2.12
<b>Year:</b>	I
<b>Semester:</b>	2
<b>Form of studies:</b>	<b>Full-time</b>
<b>Type of classes and number of hours per semester:</b>	60
Lecture	30
Exercises	0
Laboratory	30
Project	0
<b>Number of ECTS points:</b>	<b>4</b>
<b>Assessment method:</b>	<b>Exam</b>
<b>Language of lecture:</b>	English

<b>Objectives of the course</b>	
<b>C1</b>	Getting to know the multi-layer architecture of a web application and the methods of implementing its modules in the Java EE and Spring environment
<b>C2</b>	Practical learning of programming web applications on the Java Enterprise Edition platform in Spring

<b>Prerequisites for knowledge, skills and other competences</b>	
<b>1</b>	Basics of web applications
<b>2</b>	Object oriented programming
<b>3</b>	Basics of Java programming

<b>Learning outcomes</b>	
	In terms of knowledge:
<b>LO 1</b>	Knows the methods, techniques, patterns and tools used to solve advanced problems of programming web applications in the Java EE and Spring environment.
<b>LO 2</b>	Has theoretically founded, detailed knowledge related to the development, security and development trends of web applications in Java.
	In terms of skills:
<b>LO 3</b>	Can use algorithms, methods, techniques, patterns and tools to solve implementation problems in the area of web applications developed in JEE and Spring, and can obtain additional information from documentation and other sources.
<b>LO 4</b>	Is able to use in practice the knowledge related to the development of web applications in various technologies related to the Java language with the use of methods and tools for managing them.
	In terms of social competences:
<b>LO 5</b>	He is ready to critically evaluate his knowledge and to recognize its importance in solving practical problems

<b>Course content</b>	
<b>Form of classes – lectures (L)</b>	
	Program content
<b>L1</b>	Architecture of the web application, application server and component models of web applications. Technologies for the implementation of presentation logic. Java Enterprise Edition (JEE) platform and multi-tier application model. Web and business components and data layer. Basic technologies of creating Web applications in Java: servlets, JSP pages. Spring Web MVC and Spring Boot development framework. The basics of the Maven project.
<b>L2</b>	Introduction to servlet technology (Java Servlet). Servlet life cycle. Handling HTTP requests, generating http responses (HttpServletRequest and HttpServletResponse interface). Handling cookies and sessions. Securing web applications in servlets. Data validation and error handling pages.
<b>L3</b>	Creating the presentation logic of a web application on the example of the JSP templates (Java Server Pages). Directives, expressions, declarations, and scriptlets in JSP pages.
<b>L4</b>	Access to databases on the example of the JDBC (Java Database Connectivity) interface. JavaBean components.
<b>L5</b>	MVC architecture based on the integration of servlets, JavaBean components and JSP pages. Elements of the Expression Language (EL) and Java Standard Tag Library (JSTL).
<b>L6</b>	Spring infrastructure: Spring Beans, Inversion of Control (IoC) container, Aspect Oriented Programming (AOP), component factories, Data Access Objects (DAO).
<b>L7</b>	Spring Web MVC architecture. Models, views and controllers. Basic Annotations in Spring. The structure of the Maven project. Dependencies in the Maven project. The pom.xml file.
<b>L8</b>	Object-relational mapping (ORM) and Hibernate. Working with data using the Spring Data Java Persistence API (JPA). Repositories in Spring (CrudRepository, JpaRepository). Basic annotations in an entity class. JPA Relationships. Data Filtering: Inline Queries and Query methods. DTO (Data Transfer Object).
<b>L9</b>	Authentication and authorization of the user with Spring Security (Basic Authentication). Spring Boot and view templates on the example of Thymeleaf. Data validation annotations.
<b>L10</b>	REST API in Spring. Lombok Library. JSON format for data exchange and CRUD in Spring REST API. Testing REST API with Postman. Fetch API in JavaScript.
<b>L11</b>	User authentication with JSON Web Token (JWT). OAuth protocol. Securing your application with Auth0 and Rest Spring Boot API. JWT library. Web Security configuration with JWT filter.
<b>L12</b>	SOP (Same-Origin Policy) and CORS (Cross-Origin Resource Sharing) in Spring.
<b>Form of classes – laboratory (Lab)</b>	
	Program content
<b>Lab1</b>	Web application development environments in Java (NetBeans, IntelliJ). Maven project. Understanding the principles of creating web applications using the JEE environment and basic servlet interfaces (HttpServletRequest and HttpServletResponse).
<b>Lab2</b>	Creating a simple application in JSP technology with the use of declarations, expressions, scriptlets and the JavaBean component. Implementation of data validation and error page.
<b>Lab3</b>	Introduction to the MVC pattern on the example of the implementation of an application working with the MySQL database using the JDBC interface (controller servlet, JSP views, Java Bean model).
<b>Lab4</b>	Learning the principles of creating web applications using the Spring MVC programming framework, on the example of a simple CRUD application for employee management from the MySQL database using Spring JdbcTemplate.
<b>Lab5</b>	Building a project using the Spring Boot configuration and learning the methods of working with the database (H2 and MySQL) using the JPA repository.
<b>Lab6</b>	Creating a project with the possibility of user registration and login using Spring Security,

	Thymeleaf and MySQL database. Implementation of data validation in the registration form.
<b>Lab7</b>	Creating a server layer for a REST application in Spring and adding a client layer in JavaScript using the Fetch API. Testing the created REST API using the Postman.
<b>Lab8</b>	Use of DTO data transfer objects in the Spring REST API.
<b>Lab9</b>	Creating an application with user authentication by means of a JWT token using predefined user data.
<b>Lab10</b>	Creating an application with user authentication using a JWT token and MySQL.

Teaching methods	
<b>1</b>	<i>Informational lecture: multimedia presentation</i>
<b>2</b>	<i>Laboratory exercises: implementation of tasks with the use of known tools, libraries, methods and programming patterns.</i>

Evaluation methods and criteria		
Evaluation method symbol	Description of the evaluation method	Passing threshold
<b>O1</b>	<i>Passing the lecture: examination in the form of a multiple-choice test (the questions concern each of the areas of the lecture content W1 ... W12 with the same weight in the final grade).</i>	<b>51%</b>
<b>O2</b>	<i>Completion of the laboratory: assessment based on the sum of points obtained as a result of the implementation of laboratory tasks (L1-L10) and the final project.</i>	<b>51%</b>

Basic literature	
<b>1</b>	Pańczyk B., Programowanie aplikacji internetowych JEE w Spring. Przykłady i zadania, Wydawnictwo PL, 2022
<b>2</b>	Documentation Java EE, <a href="https://www.oracle.com/java/technologies/java-ee-8.html">https://www.oracle.com/java/technologies/java-ee-8.html</a>
<b>3</b>	Developing web applications in Spring, <a href="https://spring.io/web-applications">https://spring.io/web-applications</a>
Supplementary literature	
<b>1</b>	Jędrych, S., Jędruszek, B., & Pańczyk, B. (2019). Comparative analysis of web applications development using JEE and PHP. Journal of Computer Sciences Institute, 11, 86-90. <a href="https://doi.org/10.35784/jcsi.145">https://doi.org/10.35784/jcsi.145</a>
<b>2</b>	Lubartowicz, P., & Pańczyk, B. (2020). Performance comparison of web services using Symfony, Spring, and Rails examples. Journal of Computer Sciences Institute, 17, 384-389. <a href="https://doi.org/10.35784/jcsi.2371">https://doi.org/10.35784/jcsi.2371</a>

Student workload	
Form of activity	Average number of hours to complete the activity
<b>Contact hours with the lecturer, incl:</b>	60
<i>participation in lectures</i>	30
<i>participation in laboratories</i>	30
<b>Student's own work, including:</b>	40
<i>preparation for the exam</i>	5
<i>preparation for the laboratory</i>	35
<b>Total student working time</b>	100
<b>The total number of ECTS points for the course</b>	4

Macierz efektów uczenia się					
Efekt uczenia się	Odniesienie danego efektu uczenia się do efektów zdefiniowanych dla kierunku studiów	Cele przedmiotu	Treści programowe	Metody dydaktyczne	Metody oceny
EK 1	I2A_W07 +++ I2A_W01 +	CO1	L1-L12	1	A1
EK 2	I2A_W08 +++ I2A_W03 +	CO1	L1-L12	1	A1
EK 3	I2A_U13 +++ I2A_U01 ++	CO2	Lab1-Lab10	2	A2
EK 4	I2A_U15 +++ I2A_U07 ++	CO2	Lab1-Lab10	2	A2
EK 5	I2A_K01 ++ I2A_K02 +++	CO1, CO2	L1-L12, Lab1-Lab10	1, 2	A1, A2

<b>The author of the program:</b>	dr. Beata Pańczyk
<b>E-mail address:</b>	b.panczyk@pollub.pl
<b>Organizational unit</b>	Department of Computer Science