COURSE DESCRIPTION

1. Information about the program

1.1 Institution of higher education	**Alexandru Ioan Cuza University of Iasi**
1.2 Faculty	**Faculty of Economics and Business Administration**
1.3 Department	**Department of Accounting, Information Systems and Statistics**
1.4 Field of study	**Business Informatics**
1.5 Level	**Master**
1.6 Study programme/ Qualification	**Software Development and Business Information Systems**

2. Information about the course

2.1 Course name	**Multi-tier Software Development**						
2.2 Course coordinator	**Associate Prof. Cătălin STRÎMBEI, Ph.D.**						
2.3 Seminar coordinator	**Lecturer Ionuț HRUBARU, Phd.**						
2.4 Year of study	**1**	2.5 Semester	**1**	2.6 Type of assessment	**EVP**	2.7 Discipline status	**C**

** C – Compulsory / E - Elective*

3. Total estimated time (hours allotted to didactic activity per semester)

3.1 Total number of hours per week	3	of which: 3.2 lecture	2	3.3 seminar/lab	1
3.4 Total number of hours in the curriculum	42	of which: 3.5 lecture	28	3.6 seminar/lab	14

Time distribution	hours
Study of the handbook, coursebook, bibliography and notes	**30**
Additional research in the library, online and on the field	**15**
Preparation of seminars/labs, homework and projects	**40**
Tutorials	**15**
Assessment	**8**
Other activities.....	
3.7 Total number of self-study hours	**108**
3.9 Total number of hours per semester	**150**
3. 10 Number of credits	**6**

4. Prerequisites (if applicable)

4.1 curriculum-based	• Programming (or similar), • Databases (or similar)
4.2 competence-based	• Object Oriented Programming (Java) • SQL

5. Conditions (if applicable)

5.1. for lectures	• Lecture rooms shall be provided with video projector
5.2. for seminars/labs	• IT services of the faculty will provide a real or virtual machine with an JEE/Jakarta EE Application Server and an SQL Oracle Database Server. • Students are invited to bring and use their own laptops with JEE/Jakarta Platform, SQL Database (Oracle DB), a Java-based IDE (IntelliJ IDEA Community, Eclipse for Java Enterprise with Spring Tools Suite plug-in). • Labs will have enough computers for students not owning a laptop. • Lab computers will have installed a Java-based IDE (IntelliJ IDEA Community, Eclipse for Java Enterprise with Spring Suite plug-in) and network infrastructure to connect to an a JEE/Jakarta Application Server and an SQL database server (Oracle DB).

6. Assimilated specific competences	
6.1 Professional competences	• C1.3 Combine and adapt the tools, methods and techniques for analysis, design and testing of information systems based on functional and technological requirements of the system (1) • C3.3 Choose and adapt different commercial and open-source solutions in order to fulfill organizational requirements and which are suited to the organizational constraints (3) • C4.3 Identification of information sources, application modules and available services, both inside and outside the business system; estimate the solutions of their integration in order to match the current and future information needs of the organization (1.5)
6.2 Transversal competences	• CT3 – Continuous improvement of specific skills and knowledge towards approaching information systems, development of new software technologies and management of information systems. (0.5)

7. Discipline objectives (provided by the assimilated specific competences grid)	
7.1 The general objective	• To provide the core knowledge, methodologies, and tools to deal with implementation and deployment of complex enterprise business applications.
7.2 Specific objectives	• Knowledge of implementation, building and consolidation process within enterprise software engineering cycle • Knowledge of and skills for programming in Java Enterprise design patterns and technological approaches • Knowledge and skills for implementing multitier enterprise apps • Knowledge and skills for implementing service-oriented architectures

8. Content

8. 1	Lectures	Teaching methods	Observations
1.	*Capitolul 1. Enterprise Software Development Context* 1.1 Software development lifecycle and build process	Course lecture, explanation, conversation, questioning.	1 lecture
2.	1.2 Tools for Enterprise Software Development • IDE Support for enterprise applications (IntelliJ IDEA, Eclipse, Spring Tools Suite) • Building tools: Ant, Maven, Gradle. • Source code management tools: Git, SVN	Course lecture, explanation, conversation, questioning.	1 lecture

3.	*Chapter 2. Enterprise Architecture and Components*
	2.1 Layers, Containers and Components
	• Enterprise Design Patterns
	  ○ Layered Architectures
	  ○ Enterprise Components
	  ○ Components and Inversion of Control
	• Implementation Platforms:
	  ○ Spring and JEE/Jakarta EE
		Course lecture, explanation, conversation, questioning.	1 lecture

4.	2.2 Business Logic Components: Domain Model and Business Services
	• Domain Model Patterns:
	  ○ Entities, value-objects, aggregates
	  ○ Factories and repositories
	• Business Logic Patterns:
	  ○ Service Design Pattern
	  ○ Business Rules Patterns: integrity, computation, workflow rules.
	• Business Logic Implementation
	  ○ Domain Model Implementation:
	  ▪ Domain Entities and Aggregates
	  ▪ Domain Supporting Services
	  ○ Business Services
	  ▪ Computation Services,
	  ▪ Validation Services
	  ▪ Workflow Services,
	  ▪ Logging/Audit Services
	  ○ Implementation Strategies
	  ▪ Facade Strategy
	  ▪ AOP Strategy
	  ▪ Event-based Strategy
		Course lecture, explanation, conversation, questioning.	1 lecture

5.	2.3 Data Access Components
	• Design Patterns
	  ○ Data Access Objects and Entity Repositories
	• Implementations
	  ○ Data Classes (JavaBeans with Lombok library)
	  ○ Persistent Domain Entities - with JPA Support
	  ○ Entity Repositories - with JPA Support
	  ▪ JPA Facade Repository
	  ▪ Spring Data Repository
		Course lecture, explanation, conversation, questioning.	1 lecture

6.	2.4 Business Application Services
	• Design Patterns
	  ○ Application Services
	  ○ DTOs
	• Implementations
	  ○ DTOs and Object Model Mappers
	  ○ Spring Remote Services
		Course lecture, explanation, conversation, questioning.	1 lecture

7.	*Chapter 3. Service Oriented Architectures*
	3.1 SOA
	• Service Oriented Computing
	• SOA Design principles
	• Service Types
	• Service Styles:
	  ○ RPC.API, Resource API, Messaging API
	  ○ Web Services Styles: SOAP vs REST
	3.2 REST Web Services
	• HTTP.APIs: RPC vs. RESTful
	• The Architectural Principles of REST
	• Service integration with DTO
	• Simple REST Service anatomy:
	  ○ Data Transfer Objects and Resource Documents
	  ○ REST Service Providers
		Course lecture, explanation, conversation, questioning.	2 lectures

8.	3.3 RESTful Services Implementation
	• HTTP Application Protocol
	• RESTful Java Platforms
	• Spring framework for RESTful Web Services
	• Spring annotations for RESTful services
	  ○ Data Transfer Objects for RESTful web services with ModelMapper and JSON Jackson frameworks
	  ○ RESTful Data Service Development with Spring MVC
		Course lecture, explanation, conversation, questioning.	1 lecture

	○ Study Case: REST Service Implementation Steps		
9.	3.4 MSA MicroServices Architectures • Definitions • Features • Platforms 3.5 Spring Boot Apps • Configuration • Runtime and Deployment • Spring Boot Test Strategies 3.6 From Monolith to MSA • Migration Strategy • Case Study	Course lecture, explanation, conversation, questioning.	1 lecture
10.	3.7 Spring Security for Spring Boot Apps • Activation, configuration and customization 3.8 Spring Data Rest for SpringBoot Apps • Activation, configuration and test	Course lecture, explanation, conversation, questioning.	1 lecture
11.	3.9 Microservice Architecture for Cloud • PaaS and IaaS plaforms for MSA • Spring Support for Cloud Deployments		
12.	*Chapter 4. Web Presentation Layer and Web Services* 4.1 Presentation Architectural Layer • MVC Design Pattern • Business Service Layer Integration Strategy 4.2 Presentation Design Patterns • SPA vs. MPA Architectural Patterns • Web View Design Patterns 4.3 Vaadin Framework • Vaadin MVC Principles • Vaadin integration with SpringBoot Services • Vaadin Views • Vaadin Components	Course lecture, explanation, conversation, questioning.	2 lectures
8. 2	**Seminar/lab**	**Teaching methods**	**Observations**
1.	Setting Enterprise Data Components	Practical Case Discussion, Individual Practical Project-1st stage	2 lab
2.	Building Enterprise Data Repositories	Practical Case Discussion, Individual Practical Project-2nd stage	1 lab
3.	Building Web REST Data Services	Practical Case Discussion,	1 lab

		Individual Practical Project-3rd stage	
4.	Building Web Clients Apps and Integration with Web Data Services	Practical Case Discussion, Individual Practical Project-4th stage	1 lab
5.	Deploying Multitier Application Components	Practical Case Discussion, Individual Practical Project-5th stage	1 lab
6.	Integration Testing	Practical Case Discussion, Individual Practical Project-6nd stage	1 lab

Bibliography

Eric Evans, *Domain-Driven Design: tackling complexity in the heart of software*, Addison-Wesley Professional, 2004-2014
Martin Fowler, *Patterns of Enterprise Application Architecture*, Addison Wesley Professional, 2002
Vaugh Vernon, *Implementing Domain-Driven Design*, Pearson Education, 2013
Scott Millett, Nick Tune, *Patterns, Principles, and Practices of Domain-Driven Design*, Wrox John Wiley & Sons, 2015

Thomas Erl, *Service-Oriented Architecture: Analysis and Design for Services and Microservices*, Prentice Hall, 2017
Sam Newman, *Building Microservices. Designing Fine-Grained Systems*, 2nd Edition, O'Reilly, 2021
Chris Richardson, *Microservices Patterns with Examples in Java*, Manning, 2019
Magnus Larsson, *Microservices with Spring Boot and Spring Cloud*, Packt 2021
Moisés Macero García, *Learn Microservices with Spring Boot,* 2nd Edition, Apress, 2020
Alejandro Duarte, *Practical Vaadin: Developing Web Applications in Java*, Apress, 2021

Suplimentary References
Antonio Goncalves, *Beginning Java EE 7*, Apress Media, LLC, 2013
Mike Keith, Merrick Schincariol, Massimo Nardone, *Pro JPA 2 in Java EE 8: An In-Depth Guide to Java Persistence APIs,* Apress, 2018
Iuliana Cosmina, Rob Harrop, Chris Schaefer, Clarence Ho, *Pro Spring 5: An In-Depth Guide to the Spring Framework and Its Tools*, Apress, 2017
Strîmbei, Cătălin *Dezvoltarea aplicaţiilor orientate obiect pe platforma Java*, Ed.Univ.Al.I.Cuza, Iaşi, 2010

9. Corroboration of the discipline content with the expectations of epistemic community representatives, professional associations as well as of representative employers in the programme related field.

10. Assessment			
Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Share of final grade
Test EVP		Multiple choice question	25%
Part I of the project	Real-world application, complexity, validity	Presentation of the persistence model and Data/Business Architectural Model	30%

Part II of the project	Real-world application, complexity, validity	Presentation of Web Data/Business Service solution	30%
Part III of the project	Real-world application, complexity, validity	Presentation of Web Application/Consumer Modules	15%
10.6 Minimum performance standard			
• Minimum 5 for the final grade.			

Date of completion
20.09.2023

Lecture Coordinator

Assoc.Prof. Cătălin STRÎMBEI, PhD.

Seminar Coordinators

PhD. Ionuț HRUBARU

Head of Department

Prof. Mircea Asandului, PhD.

Date of approval within the department
27.09.2023