

## SYLLABUS

### 1. Information regarding the programme

1.1 Higher education institution	<b>Babeş Bolyai University</b>
1.2 Faculty	<b>Faculty of Mathematics and Computer Science</b>
1.3 Department	<b>Department of Computer Science</b>
1.4 Field of study	<b>Computer Science</b>
1.5 Study cycle	<b>Master</b>
1.6 Study programme / Qualification	<b>Software Engineering</b>

### 2. Information regarding the discipline

2.1 Name of the discipline	<b>Software design</b>						
2.2 Course coordinator	<b>Prof.PhD. Bazil Parv</b>						
2.3 Seminar coordinator	<b>Prof.PhD. Bazil Parv</b>						
2.4. Year of study	<b>1</b>	2.5 Semester	<b>2</b>	2.6. Type of evaluation	<b>E</b>	2.7 Type of discipline	<b>compulsory</b>

### 3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	<b>3</b>	Of which: 3.2 course	<b>2</b>	3.3 seminar/laboratory	<b>1</b>
3.4 Total hours in the curriculum	<b>42</b>	Of which: 3.5 course	<b>28</b>	3.6 seminar/laboratory	<b>14</b>
Time allotment:					Hours
Learning using manual, course support, bibliography, course notes					<b>30</b>
Additional documentation (in libraries, on electronic platforms, field documentation)					<b>30</b>
Preparation for seminars/labs, homework, papers, portfolios and essays					<b>70</b>
Tutorship					<b>14</b>
Evaluations					<b>14</b>
Other activities: .....					-
3.7 Total individual study hours			<b>158</b>		
3.8 Total hours per semester			<b>200</b>		
3.9 Number of ECTS credits			<b>8</b>		

### 4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"> <li>• Fundamentals of programming</li> <li>• Object-oriented programming</li> <li>• Programming paradigms</li> </ul>
4.2. competencies	<ul style="list-style-type: none"> <li>• Average programming skills</li> </ul>

### 5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> <li>• Videoprojector, Internet access</li> </ul>
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> <li>• Computers, Internet access, UML tool</li> </ul>

## 6. Specific competencies acquired

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• Understanding of the software design from the engineering perspective;</li> <li>• Understanding of the software design concepts and principles</li> <li>• Understanding of the software design process and its activities;</li> <li>• Proficient use of tools and languages specific to software systems development</li> <li>• Knowing the specifics of main architectural and design patterns and how to apply them to specific projects.</li> </ul>
<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>• Professional communication skills; concise and precise description, both oral and written, of professional results,</li> <li>• Independent and team work capabilities; able to fulfill different roles</li> <li>• Antepreneurial skills;</li> </ul>

## 7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• Know and understand fundamental concepts of software design.</li> <li>• Be able to apply the appropriate architectural and design patterns to different programming projects</li> </ul>
7.2 Specific objective of the discipline	<p>At the end of the course, students</p> <ul style="list-style-type: none"> <li>• know the main concepts and principles of software design</li> <li>• have a good understanding of the following terms: software architecture definition(s), architectural styles and models, architecture definition language(s); detailed design; design pattern, construction design;</li> <li>• learn the importance of architectural and detailed design and how to use tools for these tasks;</li> <li>• know several software system types ( taken from real-world applications) and the best recommended architectural styles and design patterns.</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
1. <i>Introduction to software engineering design.</i> Motivation and general design concepts. Overview of the software engineering design. Functional and non-functional requirements. Quality attributes. Constraints	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
2. <i>Software design process.</i> Main phases: architectural design, detailed design, construction design, data design, UI design. Inputs and deliverables	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
3. <i>Software architecture 1.</i> Definitions. Principles. Fundamentals of requirements engineering. Designing the software architecture	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
4. <i>Software architecture 2.</i> Architectural styles and patterns - overview and history. Architectural patterns for data-centered systems	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
5. <i>Software architecture 3.</i> Architectural patterns for data-flow systems	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	

6. <i>Software architecture 4.</i> Architectural patterns for distributed systems	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
7. <i>Software architecture 5.</i> Architectural patterns for interactive and hierarchical systems	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
8. <i>Detailed design 1.</i> Overview of the detailed design. Structural and behavioral design of components. Design principles	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
9. <i>Detailed design 2.</i> Creational design patterns: Abstract Factory, Factory Method, Builder, Prototype, Singleton.	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
10. <i>Detailed design 3.</i> Structural design patterns: Adapter, Bridge, Composite, Façade	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
11. <i>Detailed design 4.</i> Behavioral design patterns: Iterator, Observer, Strategy, Template Method	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
12. <i>Construction design.</i> Flow-, state-, and table-based construction design. Programming design language, styles, and quality evolution.	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
13. <i>Design evolution 1.</i> Architecture refactoring. Detailed design refactoring	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Explanation</li> <li>• Conversation</li> <li>• Didactical demonstration</li> </ul>	
14. <i>Design evolution 2.</i> Construction design refactoring	<ul style="list-style-type: none"> <li>• Interactive exposure</li> <li>• Conversation</li> </ul>	

### Bibliography

1. BASS, L., CLEMENTS, P., KAZMAN R.: *Software Architecture in Practice*, 2nd ed., Addison-Wesley, 2003
2. FOWLER, MARTIN: *Refactoring: Improving the Design of Existing Code*, Addison-Wesley, 1999
3. KRUCHTEN, PH.: *Architectural Blueprints – The 4+1 View Model of Software Architecture*, IEEE Software 12 (6), 1995, pp. 42-50.
4. MARTIN, ROBERT CECIL: *Agile software development: principles, patterns, and practices*, Pearson Education, 2002
5. McCONNELL, STEVE: *Code Complete*, 2nd ed., Microsoft Press, 2004
6. OTERO, C.E.: *Software Engineering Design*, CRC Press, 2012.  
site: <http://softwareengineeringdesign.com/Default.htm>
7. SHAW, M.: *The Coming-of-Age of Software Architecture Research*, in Proc. of the 23rd ICSE, IEEE Comp. Soc. 2001, 656, [<http://www.cs.cmu.edu/afs/cs.cmu.edu/project/vit/ftp/pdf/shaw-keynote-rev.pdf>]
8. SHAW, M., GARLAN, D.: *Software Architecture: Perspectives on an Emerging Discipline*, Prentice-Hall, 1996.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Administrivia	Conversation, debate, case studies, presentations	Seminar is organized as a total of 14 hours – 2 hours every other week
2. Establishing the target application. First miniproject started	Conversation, debate, case studies, examples	
3. Work on miniproject 1	Exposure, debate, case studies, examples	

4. Miniproject 1 due. Second miniproject started	Exposure, debate, case studies, examples	
5. Work on miniproject 2	Exposure, debate, case studies, examples	
6. Miniproject 2 due. Detailed design issues	Exposure, debate, case studies, examples	
7. Final review and project evaluation	Exposure, live demos	
<b>Bibliography</b> Students will search and use software design documentation <ul style="list-style-type: none"> <li>• on the department server (win/labor/Romana/master/SED)</li> <li>• on the web, using main CS databases</li> </ul>		

**9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program**

<ul style="list-style-type: none"> <li>• This course follows the IEEE and ACM Curricula Recommendations for Software Engineering studies;</li> <li>• Courses with similar content are taught in the major universities in Romania offering similar study programs;</li> <li>• Course content is considered very important by the software companies for improving average software development skills</li> </ul>
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**10. Evaluation**

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	<ul style="list-style-type: none"> <li>• knowing the basic concepts of software design</li> <li>• applying different architectural styles and design patterns to different problem domains</li> </ul>	Written exam	40%
10.5 Seminar/lab activities	<ul style="list-style-type: none"> <li>• be able to study and review literature regarding software design</li> <li>• be able to solve a problem using different architectural and design patterns</li> <li>• be able to evaluate a software design</li> </ul>	<ul style="list-style-type: none"> <li>• Miniproject 1 work</li> <li>• Miniproject 2 work</li> <li>• Seminar/lab attendance</li> <li>• Default</li> </ul>	20% 20% 10% 10%
10.6 Minimum performance standards			
<ul style="list-style-type: none"> <li>• At least grade 5 (from a scale of 1 to 10) at written exam and miniproject work.</li> </ul>			

Date

April 29, 2016

Date of approval

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Signature of course coordinator

Prof.PhD. Bazil PARV

Signature of seminar coordinator

Prof.PhD. Bazil PARV

Signature of the head of department

Prof.PhD. Anca ANDREICA