SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Computer Science**

2. Information regarding the discipline

2.1 Name of the discipline	**Virtual Instrumentation**						
2.2 Course coordinator	**Prof.Dipl.Eng.PhD. Horia Hedeşiu**						
2.3 Seminar coordinator							
2.4. Year of study	**3**	2.5 Semester	**6**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional**

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

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	36	Of which: 3.5 course	24	3.6 seminar/laboratory	12
Time allotment:					Hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					30
Tutorship					22
Evaluations					10
Other activities:					-

3.7 Total individual study hours	112
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	•
4.2. competencies	•

5. Conditions (if necessary)

5.1. for the course	• Course hall with projector; internet connection
5.2. for the seminar /lab activities	• computers • embedded systems myRIO • accessories for myRIO systems: sensors, displays, connectors, passive and active electronic components

6. Specific competencies acquired

Professional competencies	C 2.1 Identify adequate software systems development methodologies C 1.1 Proper description of programming paradigms and language specific mechanisms, and iden semantical an syntactical differences C4.3. Identify models and methods adequate to real life problem solving
Transversal competencies	**CT1** Apply rules to: organized and efficient work, responsabilities of didactical and scientifical activities and creative capitalization of own potential, while respecting principles and rules for professional ethics **CT3** Use efficient methods and techniques for learning, knowledge gaining, and research and develop capabilities for capitalization of knowledge, accomodation to society requirements and communication in English

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

7.1 General objective of the discipline	- Develop practical abilities to implement embedded systems, produce functional prototypes which may be used in applied research
7.2 Specific objective of the discipline	- Learning and understanding of the concepts and notions related to the graphical programming language G, respectively programming framework LabVIEW

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Virtual Instrumentation. System graphical design. Industrial Internet of Things	exposure: description, explanation, example, case studies, dialogue, debate	
2. Fundamentals of graphical programming in G 1/3 virtual instruments, VI – Front Panel, Block Diagram, Tool Palette, structures, clusters, debuggi error management	exposure: description, explanation, examples, discussion of case studies	
3. Fundamentals of graphical programming in G 2/3: implement VI, document graphical code, timing issues, developing modular apps	exposure: description, explanation, example	
4. Fundamentals of graphical programming in G 3/3: sequential programming, state machines, parallelism, multiple loops architectures, global variables,	exposure: description, explanation, example; dialogue, case studies	

event driven programming		
5. Programming Real Time Systems: introduction, components, devices configuration	exposure: description, explanation, example, dialogue, debate	
6. Architecture of Real Time Systems: Host/Target, multithreading, execution control, timing control, interprocess communication	exposure: description, explanation, example, discussion of case studies	
7. Optimization of Real Time Applications: requirements analysis, Target constraints, communication in distributed systems, memory management and system monitoring, realibility, debugging, testing, deploying	exposure: description, explanation, example, dialogue, debate, case studies	
8. PFGA Systems: components, compilation, timing issues, Single-Cycle Loop execution	exposure: description, explanation, example, case studies, dialogue, debate	
9. Image processing using VI: Introduction to Machine Vision, image acquisition and display, calibration, measurements. Image identification, bar codes, optical recognition of graphical characters	exposure: description, explanation, example, case studies, dialogue, debate	
10. Human Machine Interface, data output on mobile devices: graphical interfaces, G web server, LabView WebServices, SCADA elements with applications, Data Dashboard	exposure: description, explanation, example, case studies, dialogue, debate	
11. Rapid Prototyping. MyRIO • emebedded systems in education: MyRIO • Measurements applications. • Simple control Applications • IIoT and Embedded Systems		
12. Real Time Systems Modelling: Model-in-the-loop, SW-in-the-loop, HW-in-the-loop	exposure: description, explanation, example, case studies, dialogue, debate	

Bibliography

ă1] Horia Hedesiu, Radu Munteanu jr. –Introducere in Programare Grafica Instrumentala, ISBN 973-9357-48
Mediamira, Cluj-Napoca, 2003

[2] Gabriel Chindris, Horia Hedesiu - Proiectarea Grafica a Sistemelor de Control Pentru

Aplicatii Industriale, ISBN 978-973-713-242-0, Editura Mediamira Cluj-Napoca, 2009

[3] National Instruments Corp – LabVIEW Core 1 Course Manual, 2013 Edition

[4] National Instruments Corp – LabVIEW Core 2 Course Manual, 2013 Edition

[5] National Instruments Corp – LabVIEW Core 3 Course Manual, 2013 Edition

[6] Kye-Si Kwon, Steven Ready - Practical Guide to Machine Vision Software: An Introduction with LabVIEW, Jan. 2015)

[7] Blume, Peter A. - The LabVIEW Style book, ISBN 0-13-145835-3, Pearson Education, 2007

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Graphical programming in G 1/2	Explation, dialogue, case studies	
2. Graphical programming in G 2/2	Explation, dialogue, case studies	
3. Real Time Application development	Explation, dialogue, case studies	
4. Real Time Systems Architecture	Evaluation	
5. Image processing using VI	Explation, dialogue, case studies	
6. Rapid Prototyping	Explation, dialogue, case studies	
7. Final project turn-in	Evaluation	

Bibliography

ă1] Horia Hedesiu, Radu Munteanu jr. –Introducere in Programare Grafica Instrumentala, ISBN 973-9357-48- Mediamira, Cluj-Napoca, 2003

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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

- The course respects the IEEE and ACM Curriculla Recommendations for Computer Science studies;
- The course exists in the studying program of all major universities in Romania and abroad;
- The content of the course is considered the software companies as important for advanced programming skills

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)

10.4 Course	Final project: architecture & design pattern application	Project grading	40%
10.5 Seminar/lab activities	Lab Assignments	-Mini-projects grading	60%
10.6 Minimum performance standards			
- A minimum passing grade is defined by attaining at least 50% (5/10) points for the final project and each of the three lab assignments respectively.			

Date Signature of course coordinator Signature of seminar coordinator
..... Prof.Dipl.Eng.PhD. Horia Hedeșiu

Date of approval Signature of the head of department
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