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	**Computers and Information Technology**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Information Engineering**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			Virtual Instrumentation Instrumentare virtuală				
2.2 Course coordinator			Prof. Dipl. Eng. PhD. Horia HEDEȘIU				
2.3 Seminar / Laboratory coordinator							
2.4. Year of study	**III**	2.5 Semester	**6**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory DD**
2.8 Code of the discipline		MLE5092					

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

3.1 Hours per week	5	Of which: 3.2 course	3	3.3 seminar/laboratory	2 LP
3.4 Total hours in the curriculum	70	Of which: 3.5 course	42	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					10
Additional documentation (in libraries, on electronic platforms, field documentation)					10
Preparation for seminars/labs, homework, papers, portfolios and essays					5
Tutorship					-
Evaluations					5
Other activities:					-

3.7 Total individual study hours	**30**
3.8 Total hours per semester	**100**
3.9 Number of ECTS credits	**4**

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	C5.1 Appropriate use of the operating principles of electronic devices and circuits, as well as methods of measuring electrical quantities C5.2 Analysing, designing, executing and measuring of electronic circuits of low/ medium complexity C5.3 Diagnosis / troubleshooting of electronic circuits and instruments C5.4 Use of electronic tools to characterize and evaluate the performance of electronic circuits C5.5 Designing electronic circuits of low / medium complexity and implementing them using CAD techniques
Transversal competencies	CT1 Honorable, responsible, ethical conduct in the spirit of the law to ensure the reputation of the profession CT3 Demonstrate the spirit of initiative and action to update professional, economic and organizational culture knowledge

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, debugging, error management		
3. Fundamentals of graphical programming in G 2/3: implement VI, document graphical code, timing issues, developing modular apps		
4. Fundamentals of graphical programming in G 3/3:		

sequential programming, state machines, parallelism, multiple loops architectures, global variables, event driven programming		
5. Programming Real Time Systems: introduction, components, devices configuration		
6. Architecture of Real Time Systems: Host/Target, multithreading, execution control, timing control, interprocess communication		
7. Optimization of Real Time Applications: requirements analysis, Target constraints, communication in distributed systems, memory management and system monitoring, reliability, debugging, testing, deploying		
8. PFGA Systems: components, compilation, timing issues, Single-Cycle Loop execution		
9. Image processing using VI: Introduction to Machine Vision, image acquisition and display, calibration, measurements. Image identification, bar codes, optical recognition of graphical characters		
10. Human Machine Interface, data output on mobile devices: graphical interfaces, G web server, LabView WebServices, SCADA elements with applications, Data Dashboard		
11-12. Rapid Prototyping. MyRIO • emebedded systems in education: MyRIO • Measurements applications. • Simple control Applications • IIoT and Embedded Systems		
13-14. Real Time Systems Modelling: Model-in-the_loop, SW-in-the-loop, HW-in-the-loop		

Bibliography

[1] Horia Hedesiu, Radu Munteanu jr. –Introducere in Programare Grafica Instrumentala, ISBN 973-9357-48-2, Editura 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, Wiley VCH (14 Jan. 2015)
[7] Blume, Peter A. - The LabVIEW Style book, ISBN 0-13-145835-3, Pearson Education, 2007

8.2. Laboratory	Explanation, dialogue, case studies	Remarks
1-2. Graphical programming in G 1/2		
3-4. Graphical programming in G 2/2		
5-6. Real Time Application development		
7-8. Real Time Systems Architecture		
9-10. Image processing using VI		
11-12. Rapid Prototyping		

13-14. Final project turn-in	Evaluation	

Bibliography

[1] Horia Hedesiu, Radu Munteanu jr. –Introducere in Programare Grafica Instrumentala, ISBN 973-9357-48-2, Editura 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

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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

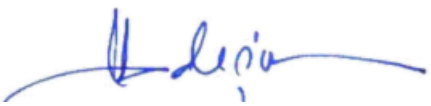
10. Evaluation

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%
10.5.2 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

May 2022 — Prof. Dipl. Eng. PhD.

Horia HEDEȘIU



Date of approval — Signature of the head of department

Prof. dr. Laura Dioșan

24.05.2022