# **SYLLABUS**

1. Information regarding the programme

	F 0
1.1 Higher education	Babes-Bolyai University
institution	
1.2 Faculty	Mathematics and Informatics
1.3 Department	Informatics
1.4 Field of study	Informatics
1.5 Study cycle	Licence
1.6 Study programme /	Informatics - english
Qualification	

2. Information regarding the discipline

21 mior mation regarding the discipline								
2.1 Name of the di	sciplin	e (en)	Virtual reality					
(ro)	Realitate virtuală							
2.2 Course coordin	nator		Assoc. prof. Rares Boian					
2.3 Seminar coordinator			As	Assoc. prof. Rareş Boian				
2.4. Year of study	3	2.5 Semester	• 5	2.6. Type of	<u>C</u> .	2.7 Type of	Optional	
		evaluation discipline				Pullul		
2.8 Code of the <b>MLE5061</b>								
discipline								

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3	2
				seminar/laboratory	
3.4 Total hours in the curriculum	<b>56</b>	Of which: 3.5 course	28	3.6	28
				seminar/laboratory	
Time allotment:					
Learning using manual, course support, bibliography, course notes					
Additional documentation (in libraries, on electronic platforms, field documentation)					
Preparation for seminars/labs, homework, papers, portfolios and essays					
Tutorship					
Evaluations					
Other activities:					

3.7 Total individual study hours	44
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	•	The requirements posted here http://www.cs.ubbcluj.ro/~rares/course/vr/	
5.2. for the seminar /lab		Lab rooms with Windows and UNIS operating system access	•
activities	•	The requirements posted here http://www.cs.ubbcluj.ro/~rares/course/vr/	

6. Specific competencies acquired

or opecime con	ipetencies acquired
	• Define notions, concepts, theories and models of virtual reality systems.
Professional competencies	· Critical analysis and use of the principles, methods and techniques work for quantitative and qualitative evaluation of the processes within an virtual reality systems
·	· Apply basic concepts and theories in the field of virtual reality, programming methods and professional project development
Transversal competencies	· Execution of the tasks required under specified requirements and the deadlines imposed, with the rules of professional ethics and moral conduct
	· Information and permanent documentation in its field
	· Seeking to improve business results by engaging in professional activities

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

7.1 General objective of the discipline	Introducing the students to virtual reality environment programming.  The students should learn the following concepts: general structure of a virtual reality application, human interaction with the virtual environment through the use of input devices, modeling (visual, physical, tactile, and force), and character animation. In the end the students should be able to create a multi-sensory, interactive virtual
7.2 Specific objective of the discipline	reality application.  Reprezentarea modelelor virtuale  Structura generala a unei aplicatii de realitate virtuala  Reprezentarea pozitionarii si orientarii unui obiect in spatiu.  Matrici de transformare  Interactiunea cu sezori si aparatura externa  Tehnici de optimizare ale mediilor virtuale  Simulare realista bazaata pe legile fizicii

8. Content 8.1 Course	Teaching methods	Remarks
Weeks 1 - 3	Exposition:	Kemarks
1. Introduction to virtual environments,	presentation,	
input/output	explanations,	
devices, state of the art	practical examples,	
2. Scene definition	demonstrations,	
3. Ray tracing	case-study	
, 0	discussions	
Weeks 4 - 6	Exposition:	
4. Virtual object modeling (geometric primitives,	presentation,	
custom build geometries)	explanations,	
5. Virtual reality application architecture	practical examples,	
6. Position and orientation representation	demonstrations,	
(position	case-study	
vector, Euler angles, orientation matrix,	discussions	
7. JMonkey3D introduction		
8. Scene graph (reference frames, node hierarchy,		
node types, light nodes, fog)		

Weeks 7 - 9	Exposition:
9. JMonkey3D examples	presentation,
10. JMonkey3D examples	explanations,
11. Scene optimizations (level of details, textures,	practical examples,
cell-segmentation)	demonstrations,
	case-study
	discussions
Weeks 9 - 12	Exposition:
12. Collision detection	presentation,
13. Simulating spatial phenomena (fog, smoke,	explanations,
fire,	practical examples,
fluids)	demonstrations,
14. Physics engines	case-study
15. Character animation	discussions

### **Bibliography**

- 1. CRAIG J.J., Introduction to Robotics: Mechanics and Control (3rd edition), Prentice Hall, 2003
- 2. BURDEA G.C., COIFFET P., Virtual Reality Technology, Second Edition with CD-ROM, Wiley-IEEE Press, 2003
- 3. FOLEY J.D., VAN DAM A., FEINER S.K., HUGHES J.F, Computer Graphics: Principles and Practice in C (2nd Edition), Addison-Wesley Professional, 1995
- 4. OpenGL Architecture Review Board, SHREINER D, WOO M., NEIDER J., OpenGL(R) Programming Guide: The Official Guide to Learning OpenGL(R), Version 2 (5th Edition), Addison-Wesley Professional, 2005
- 5. ERICSON C. Real-Time Collision Detection, Morgan Kaufmann, 2004

6. \*\*\* JMonkey3D Documentation, http://jmonkeyengine.com

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Ray Tracing and geometrical concepts	Explanation,	
	examples, dialog,	
	case-studies	
2. Ray Tracing	Explanation,	
	examples, dialog,	
	case-studies	
3. Articulated models	Explanation,	
	examples, dialog,	
	case-studies	
4. Articulated models	Explanation,	
	examples, dialog,	
	case-studies	
5. Semester project	Explanation,	
	examples, dialog,	
	case-studies	
6. Semester project	Explanation,	
	examples, dialog,	
	case-studies	

#### **Bibliography**

- 1. CRAIG J.J., Introduction to Robotics: Mechanics and Control (3rd edition), Prentice Hall, 2003
- 2. BURDEA G.C., COIFFET P., Virtual Reality Technology, Second Edition with CD-ROM, Wiley-IEEE Press, 2003
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- 4. OpenGL Architecture Review Board, SHREINER D, WOO M., NEIDER J., OpenGL(R) Programming Guide: The Official Guide to Learning OpenGL(R), Version 2 (5th Edition), Addison-Wesley

# Professional, 2005

- 5. ERICSON C. Real-Time Collision Detection, Morgan Kaufmann, 2004
- 6. \*\*\* JMonkey3D Documentation, http://jmonkeyengine.com

# 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

- · By learning the theoretical and methodological concepts and addressing the practical aspects of the Virtual Reality course, students acquire a body of knowledge consistent, consistent with partial competencies required for possible occupations provided in Grid 1 RNCIS
- The course complies with IEEE and ACM Curriculla Recommendations for Computer Science studies.
- The course curriculum exists in universities and faculties in Romania
- · The course content is very well appreciated by software companies whose employees and graduates of this course

## 10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	The level of knowledge and understanding of the course subjects  Problem solving	Project evaluation	40%
10.5 Seminar/lab activities	2	Semester project evaluation	60%
10.6 Minimum performance	ce standards		
Ø Minimum 5 in the	final grade		

Date	Signature of course coordinator	Signature of seminar coordinator	
10.05.2016	Assoc.prof. Rareş Boian	Assoc.prof. Rareş Boian	
Date of approval	Signature of the head of department		
	Prof	Prof.dr. Anca Andreica	