syllabus

1. Information regarding the programme

1.1 Higher education institution	**Babes-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 reality Realitate virtuală**				
2.2 Course coordinator			**Assoc. prof. Rareș Boian**				
2.3 Seminar coordinator			**Assoc. prof. Rareș Boian**				
2.4. Year of study	**4**	2.5 Semester	**7**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional DS**
2.8 Code of the discipline		**MLE5061**					

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 LP**
3.4 Total hours in the curriculum	**42**	Of which: 3.5 course		**28**	3.6 seminar/laboratory	**14**
Time allotment:						hours
Learning using manual, course support, bibliography, course notes						**15**
Additional documentation (in libraries, on electronic platforms, field documentation)						**20**
Preparation for seminars/labs, homework, papers, portfolios and						**15**

essays						
Tutorship						**4**
Evaluations						**4**
Other activities:						
3.7 Total individual study hours		**58**				
3.8 Total hours per semester		**100**				
3.9 Number of ECTS credits		**5**				

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 activities	· Lab rooms with Windows operating system access · The requirements posted here http://www.cs.ubbcluj.ro/~rares/course/vr/

6. Specific competencies acquired

Professional competencies	C3.3 Applying solution patterns using specific engineering tools and mehods C3.4 Comparatively and experimentaly evaluation of the alternative solutions for performance optimization C3.5 Developing and implementing information system solutions for concrete problems C6.3 Use of simulation and programming environments to process signals and model solutions to problem classes
Transversal competencies	CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation CT2 Identifying, describing and conducting processes in the project management field, undertaking different team roles and clearly and concisely describing own profesional results, verbally or in writing CT3 Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge

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 reality application.
7.2 Specific objective of the discipline	· Virtual model representation · General architecture of a virtual reality application · Object position and orientation specification methods · Transform matrices · Interacting with external sensors and devices · Optimization techniques · Physical based modelling

8. Content

8.1 Course	Teaching methods	Remarks
Weeks 1 - 3 1. Introduction to virtual environments, input/output devices, state of the art 2. Scene definition 3. Ray tracing	Exposition: presentation, explanations, practical examples, demonstrations, case-study discussions	
Weeks 4 - 6 4. Virtual object modeling (geometric primitives, custom build geometries) 5. Virtual reality application architecture 6. Position and orientation representation (position vector, Euler angles, orientation matrix, 7. JMonkey3D introduction 8. Scene graph (reference frames, node hierarchy, node types, light nodes, fog)	Exposition: presentation, explanations, practical examples, demonstrations, case-study discussions	
Weeks 7 - 9 9. JMonkey3D examples 10. JMonkey3D examples 11. Scene optimizations (level of details, textures, cell-segmentation)	Exposition: presentation, explanations, practical examples, demonstrations, case-study discussions	
Weeks 9 - 12 12. Collision detection 13. Simulating spatial phenomena (fog, smoke, fire, fluids) 14. Physics engines 15. Character animation	Exposition: presentation, explanations, practical examples, demonstrations, case-study 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	
6-7. 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 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		

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	Project evaluation	40%
	Problem solving		
10.5 Seminar/lab activities	Ability to solve practical problems, specific to the course subjects, on the computer in a given amount of time	Semester project evaluation	60%
	Lab activity		
10.6 Minimum performance standards			
Minimum 5 in the final grade			

Date	Signature of course coordinator	Signature of seminar coordinator
16.05.2022	Assoc.prof. Rareș Boian	Assoc.prof. Rareș Boian

Date of approval	Signature of the head of department
24.05.2022	Prof.dr.Laura Diosan