# SYLLABUS

## 1. Information regarding the programme

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| 1.1 Higher education institution | **Babes-Bolyai University** |
| 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 / Qualification | **Informatics - english** |

## 2. Information regarding the discipline

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|---|---|---|---|---|---|---|---|
| 2.1 Name of the discipline (en)<br>(ro) | | | **Virtual reality**<br>**Realitate virtuală** | | | | |
| 2.2 Course coordinator | | | **Assoc. prof. Rareş Boian** | | | | |
| 2.3 Seminar coordinator | | | **Assoc. prof. Rareş Boian** | | | | |
| 2.4. Year of study | **3** | 2.5 Semester | **5** | 2.6. Type of evaluation | **C** | 2.7 Type of discipline | **Optional** |
| 2.8 Code of the discipline | | **MLE5061** | | | | | |

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

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|---|---|---|---|---|---|
| 3.1 Hours per week | **4** | Of which: 3.2 course | **2** | 3.3 seminar/laboratory | **2** |
| 3.4 Total hours in the curriculum | **56** | Of which: 3.5 course | **28** | 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) | | | | | **5** |
| Preparation for seminars/labs, homework, papers, portfolios and essays | | | | | **19** |
| Tutorship | | | | | **5** |
| Evaluations | | | | | **5** |
| Other activities: ..... | | | | | |

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| 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)

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| 4.1. curriculum | · |
| 4.2. competencies | · |

## 5. Conditions (if necessary)

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| 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 and UNIS operating system access<br>· The requirements posted here http://www.cs.ubbcluj.ro/~rares/course/vr/ | · |

**6. Specific competencies acquired**

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|---|---|
| **Professional competencies** | · Define notions, concepts, theories and models of virtual reality systems.<br>· Critical analysis and use of the principles, methods and techniques work for quantitative and qualitative evaluation of the processes within an virtual reality systems<br>· 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<br>· Information and permanent documentation in its field<br>· Seeking to improve business results by engaging in professional activities |

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

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| 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 | · Reprezentarea modelelor virtuale<br>· Structura generala a unei aplicatii de realitate virtuala<br>· Reprezentarea pozitionarii si orientarii unui obiect in spatiu.<br>· Matrici de transformare<br>· Interactiunea cu sezori si aparatura externa<br>· Tehnici de optimizare ale mediilor virtuale<br>· Simulare realista bazaata pe legile fizicii |

**8. Content**

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

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|---|---|---|
| Weeks 7 - 9<br>9. JMonkey3D examples<br>10. JMonkey3D examples<br>11. Scene optimizations (level of details, textures, cell-segmentation) | Exposition: presentation, explanations, practical examples, demonstrations, case-study discussions | |
| Weeks 9 - 12<br>12. Collision detection<br>13. Simulating spatial phenomena (fog, smoke, fire,<br>fluids)<br>14. Physics engines<br>15. Character animation | Exposition: presentation, explanations, practical examples, demonstrations, case-study discussions | |
| Bibliography<br>1. CRAIG J.J., Introduction to Robotics: Mechanics and Control (3rd edition), Prentice Hall, 2003<br>2. BURDEA G.C., COIFFET P., Virtual Reality Technology, Second Edition with CD-ROM, Wiley-IEEE Press, 2003<br>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<br>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<br>5. ERICSON C. Real-Time Collision Detection, Morgan Kaufmann, 2004<br>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<br>1. CRAIG J.J., Introduction to Robotics: Mechanics and Control (3rd edition), Prentice Hall, 2003<br>2. BURDEA G.C., COIFFET P., Virtual Reality Technology, Second Edition with CD-ROM, Wiley-IEEE Press, 2003<br>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<br>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 | | | |
| 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.dr. Anca Andreica