804222 - FIS1VJ - Physics I

Coordinating unit: 804 - CITM - Image Processing and Multimedia Technology Centre
Teaching unit: 804 - CITM - Image Processing and Multimedia Technology Centre
Academic year: 2019
Degree: BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: Miquel Sureda
Others: Miquel Sureda

Opening hours
Timetable: To be determined.

Degree competences to which the subject contributes

Specific:
1. Analyse, decide upon and apply graphic programming techniques, physics, artificial intelligence, interaction, augmented reality and networks to a video game project.

General:
2. Interpret and master the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism; and their application for solving engineering problems.
Learning objectives of the subject

- Learn and use the basic laws of mechanics. Calculation of particle trajectories in the classical radial force fields. Moving under the gravitational field.
- Learn the basic principles of electromagnetism. Understanding the effects associated with electric and magnetic fields.
- Use basic knowledge for the study of wave phenomena, and in particular, its effects on the various elements that could be part of a game or animation realistic.
- Know and understand the principles of mechanics typically associated with game development: direct and inverse kinematics; collision detection. Relative motion.
- Understand the basic principles of game engine software and its appropriate use.
- To obtain valid experimental results, analyze them and discuss them properly.
- Being able to assess the efficiency and utility of the methods and tools for modeling and simulation in the usual video game design and programming and realistic animations.
- To critically analyze the results.
- Solving problems related to the basics.
- Planning oral communication, respond appropriately to the questions posed and write texts with basic spelling and grammar.
- Engage in teamwork and positive contributions once the objectives and individual and collective responsibilities and jointly decide the strategy to be followed.
- Identify information needs and use collections, spaces and services available to design and run simple searches appropriate to the topic.
- To carry out the tasks assigned on time, working with information sources, according to the guidelines set by teachers.
- Demonstrate sufficient comprehension in reading documents written in English, related to the subject, such as notes taken in class, scientific articles, popular articles, websites, etc.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 34h</th>
<th>22.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 16h</td>
<td>10.67%</td>
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<tr>
<td></td>
<td>Hours small group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Guided activities: 10h</td>
<td>6.67%</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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</table>
### Content

#### Introductory Physics

**Learning time:** 14h  
Practical classes: 4h  
Guided activities: 2h  
Self study: 8h

**Description:**  
Introduction and review of basic physics and mathematical tools:  
- Magnitudes, units and dimensions, significant digits, scientific notation, magnitude order.  
- Coordinate systems and relative position.  
- Basics on vector and differential calculus.

**Related activities:**  
Theoretical lessons, exercises, practices with computer

**Specific objectives:**  
Learn and review basic physical and mathematical concepts: systems of units, dimensional analysis, vector algebra.

#### Kinematics

**Learning time:** 30h  
Practical classes: 10h  
Guided activities: 2h  
Self study: 18h

**Description:**  
Description of the motion in 2D.  
- Basics on kinematics: path, velocity and acceleration.  
- Movement equations: Uniform and non-uniform  
- Circular movement

**Related activities:**  
Theoretical lessons, exercises, practices with computer

**Specific objectives:**  
Learn how to understand and how to calculate the trajectory that describes a free point particle in two dimensions, in order to apply it in the dynamics of specific objects in simple videogames.
### Dynamics

**Learning time:** 30h  
Practical classes: 10h  
Guided activities: 2h  
Self study: 18h

**Description:**  
Description of linear and circular movement under force action.  
- Newton's law and force balance.  
- Contact forces and friction.  
- Relative movement: inertial–non inertial frames

**Related activities:**  
Theoretical lessons, exercises, practices with computer

**Specific objectives:**  
Studying the motion of bodies in mobile coordinate systems, understand how to change from a fixed coordinate system to the mobile one and vice versa.

### Energy

**Learning time:** 26h  
Practical classes: 10h  
Self study: 16h

**Description:**  
Description of energy conservation and derived physics.  
- Potential, kinetic and elastic energy.  
- Energy conservation

**Related activities:**  
Lectures, practical exercises, practices with computer
### Collisions.

**Description:**
Description kinematics under collision conditions in 1D and 2D.
- Momentum conservation.
- Collisions in 1D and 2D: elastic and fully inelastic, non frontal collisions.

**Related activities:**
Theoretical lectures, applications and practices based on computer.

**Specific objectives:**
Learn the basics of a collision between particles in two dimensions, the variety of existing collisions and their numerical treatment. Predict the angles, velocities and trajectories out in a collision.

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<thead>
<tr>
<th>Learning time: 30h</th>
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<tbody>
<tr>
<td>Practical classes: 10h</td>
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<tr>
<td>Guided activities: 2h</td>
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<tr>
<td>Self study: 18h</td>
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### Harmonics

**Description:**
Basics on oscillatory movement.
- Oscillatory movement: waves.
- Simple harmonic motions.

**Related activities:**
Lectures, exercises and practical application with computer.

**Specific objectives:**
Understanding the basic physical characteristics of the oscillatory motion and wave as the preamble to the study of light.

<table>
<thead>
<tr>
<th>Learning time: 20h</th>
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<tbody>
<tr>
<td>Practical classes: 6h</td>
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<tr>
<td>Guided activities: 2h</td>
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<tr>
<td>Self study: 12h</td>
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</table>
# Planning of activities

<table>
<thead>
<tr>
<th>ACTIVITY 1: LECTURES AND PRACTICAL EXERCISES</th>
<th>Hours: 60h</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Self study: 30h</td>
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<tr>
<td>Development of theoretical concepts and supervision of practical exercises.</td>
<td>Theory classes: 30h</td>
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<tr>
<td><strong>Support materials:</strong></td>
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<tr>
<td>Course notes.</td>
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<tr>
<td>Collections of problems.</td>
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<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
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<tr>
<td>Weekly.</td>
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<thead>
<tr>
<th>ACTIVITY 2: TUTORIAL EXERCISES (4)</th>
<th>Hours: 12h</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 12h</td>
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<tr>
<td>Compendium of exercises related to each of the blocks of the subject</td>
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<tr>
<th>ACTIVITY 3: COMPUTER BASED PRACTICE (1)</th>
<th>Hours: 60h</th>
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<tr>
<td><strong>Description:</strong></td>
<td>Laboratory classes: 30h</td>
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<tr>
<td>Development of practical activities using computer simulation programs suitable to represent physical systems.</td>
<td>Theory classes: 30h</td>
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<tr>
<th>ACTIVITY 4: INDIVIDUAL EVALUATION TESTS</th>
<th>Hours: 18h</th>
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<tr>
<td><strong>Description:</strong></td>
<td>Laboratory classes: 8h</td>
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<tr>
<td>Partial and final exams</td>
<td>Self study: 10h</td>
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</table>
The qualification of the subject will be obtained following a system of continuous evaluation. There will be one written test during the course (Partial I), four (4) practical exercises (PE), one (1) computer practice (T) to be delivered and a final exam. The weight of each part is as follows:

- Partial Exam I - 30%
- Final Exam - 30%
- Practical exercises (4) - 20%
- Computer practice (1) - 10%
- Participation - 10%

If the pass mark is not obtained, there is the possibility of a reevaluation exam and the obtained qualification will substitute those of the partial exams and the final exam. The maximum mark to be obtained in the reevaluation is 5.

Practical Exercises (PE):
During four of the theory lectures, the student will develop exercises in pairs. Then, these exercises will be discussed and corrected in the same lecture, and a mark will be obtained for each pair.

Computer tutorials (T):
Computer tutorials should be submitted within the indicated deadline, in pdf format. Complementary material (Excel, Matlab, Phyton), if convenient, should be submitted as well.

Bibliography

Basic:

Others resources: