
Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2019
Degree: MASTER'S DEGREE IN INNOVATION AND RESEARCH IN INFORMATICS (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: English

Prior skills

Linear Algebra

Need to refresh it?

- Here is an elementary textbook:

- And here is an basic tutorial notebook for Mathematica:
http://www.farinhansford.com/books/pla/downloads.html

Teaching methodology

There will be theory classes, problems solving classes, and laboratory classes. Theory classes are aimed at presenting and discussing the geometric techniques included in the syllabus. These classes will be mainly conducted by the instructor. Problems solving and laboratory classes are aimed at consolidating the knowledge acquired and its specific application. In these classes, students will present, discuss (problems) and implement (laboratory) their solutions to problems that will have been posed in advance.

Learning objectives of the subject

2. By the end of the course, students should be able to easily use the mathematical and geometric concepts and tools that are most useful in computer graphics.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 30h</th>
<th>20.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Hours small group: 3h</td>
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<tr>
<td></td>
<td>Guided activities: 6h</td>
<td>4.00%</td>
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<tr>
<td></td>
<td>Self study: 96h</td>
<td>64.00%</td>
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Content

Basics of affine and metric geometry

Degree competences to which the content contributes:
Description:
Vectorial spaces.
Affine spaces. Coordinate systems. Affine manifolds in dimensions 2 and 3.
Changing coordinates.

Linear geometric objects, curves and surfaces

Degree competences to which the content contributes:
Description:
Linear objects.
Curves in dimensions 2 and 3. Parametrizations. Rudiments of differential geometry of curves.
Surface intersections.

Affine transforms

Degree competences to which the content contributes:
Description:
Rigid motions, similarities and affinities.
Using quaternions in rotations.

Basic geometric algorithms

Degree competences to which the content contributes:
Description:
Triangulating polygons.
Triangulating point sets. Delaunay triangulation.
Point location in planar decompositions.
Convex hull in 3D.
### Planning of activities

| Lectures | Hours: 87h  
Theory classes: 27h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 60h |
| --- | --- |
| Description:  
Presenting and discussing the subjects included in the syllabus |
| Specific objectives:  
2 |

| Problems solving sessions | Hours: 50h  
Theory classes: 0h  
Practical classes: 20h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 30h |
| --- | --- |
| Description:  
Solving, presenting and discussing problems |
| Specific objectives:  
2 |

| Lab sessions | Hours: 13h  
Theory classes: 0h  
Practical classes: 0h  
Laboratory classes: 7h  
Guided activities: 0h  
Self study: 6h |
| --- | --- |
| Description:  
Implementing solutions and visualizing their results |
| Specific objectives:  
2 |

### Qualification system

Along the course, students will get assigned some problems solving and implementing. This homework will be presented in class by the students, and revised by the instructor, giving as a result the homework component of the final grade (H). There will also be a final written exam, mainly devoted to problems solving, which will give the exam component of the final grade (E). The final grade (F) will be obtained by the following formula: \( F = \max (E, (H+E)/2) \).
Bibliography

Basic:

Complementary:

Others resources:
Hyperlink
https://dccg.upc.edu/people/vera/teaching/courses/geometric-tools-for-computer-graphics/

http://www.sagemath.org/

https://cocalc.com/

http://bibliotecnica.upc.edu/