270180 - DCS - Curve and Surface Design

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2018
Degree: BACHELOR’S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 6  Teaching languages: Catalan

Teaching staff
Coordinator: - Rodrigo Ignacio Silveira (rodrigo.silveira@upc.edu)

Prior skills
- English
- Basic knowledge of JavaScript

Degree competences to which the subject contributes

Generical:
G9. PROPER THINKING HABITS: capacity of critical, logical and mathematical reasoning. Capacity to solve problems in her study area. Abstraction capacity: capacity to create and use models that reflect real situations. Capacity to design and perform simple experiments and analyse and interpret its results. Analysis, synthesis and evaluation capacity.

Teaching methodology
The course has a theoretical and a practical part. The theory lectures will introduce the main mathematical concepts related to the different types of curves and surfaces. The students will get familiar with the practical aspects of these different topics by carrying out a number of practical, implementation-based assignments.

Learning objectives of the subject
1. Know the main types of curves used in graphics and CAD/CAM
2. Become familiar with practical aspects in the implementation of algorithms for curves
3. Know some of the types of surfaces used in graphics and CAD/CAM
4. Become familiar with practical aspects in the implementation of algorithms for surfaces

Study load

<table>
<thead>
<tr>
<th>Total learning time: 165h</th>
<th>Hours large group: 0h</th>
<th>0.00%</th>
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<tbody>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td>Hours small group:</td>
<td>60h</td>
<td>36.36%</td>
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<tr>
<td>Guided activities:</td>
<td>3h</td>
<td>1.82%</td>
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<tr>
<td>Self study:</td>
<td>102h</td>
<td>61.82%</td>
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### Content

**Fundamentals**

**Degree competences to which the content contributes:**

**Description:**
Basic notions of vector and affine spaces. Parametrizations of affine varieties.

**Parametrizing curves**

**Degree competences to which the content contributes:**

**Description:**
How to mathematically describe a curve. Tangent vector, normal vector, osculating plane and curvature. Conics.

**Interpolating curves**

**Degree competences to which the content contributes:**

**Description:**

**Approximating curves**

**Degree competences to which the content contributes:**

**Description:**
Bézier curves. B-Splines. Considerations on the efficiency of the computation of the curves.

**Surfaces: parametrization and approximation**

**Degree competences to which the content contributes:**

**Description:**
Methods to model a surface. Quadric surfaces. Vector normal to a surface at a point. Bézier surfaces. NURBS surfaces.
### Planning of activities

| Theory | **Hours**: 41h 30m  
Theory classes: 36h 30m  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 5h |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Lectures about the different types of curves and surfaces</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td>1, 3</td>
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| Lab work | **Hours**: 34h 36m  
Theory classes: 0h  
Practical classes: 0h  
Laboratory classes: 15h 48m  
Guided activities: 3h 48m  
Self study: 15h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Implementation of some of the topics covered in the theory lectures</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td>2, 4</td>
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| Exam | **Hours**: 14h  
Theory classes: 1h  
Practical classes: 0h  
Laboratory classes: 3h  
Guided activities: 0h  
Self study: 10h |
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<tr>
<td><strong>Specific objectives:</strong></td>
<td>1, 2, 3, 4</td>
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### Qualification system

The course will be graded based on:
- Handing-in the practical assignments that will be carried out during the lab sessions (50% of the final grade).
- A final exam, covering theory and practice (50% of the final grade).
Bibliography

**Basic:**


**Complementary:**