Course guides

200122 - GD - Differential Geometry

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Compulsory subject).

Academic year: 2021   ECTS Credits: 7.5   Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: JOSE BURILLO PUIG

Others: Segon quadrimestre:
JOSE BURILLO PUIG - M-A, M-B
FRANCESC XAVIER GRACIA SABATE - M-A
PAU MARTIN DE LA TORRE - M-B

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
2. CE-3. Have the knowledge of specific programming languages and software.
3. CE-4. Have the ability to use computational tools as an aid to mathematical processes.

Generical:
5. CB-1. Demonstrate knowledge and understanding in Mathematics that is founded upon and extends that typically associated with Bachelor's level, and that provides a basis for originality in developing and applying ideas, often within a research context.
6. CB-2. Know how to apply their mathematical knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader or multidisciplinary contexts related to Mathematics.
7. CB-3. Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements.
8. CG-1. Show knowledge and proficiency in the use of mathematical language.
10. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
11. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
12. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
4. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

(Section not available)

LEARNING OBJECTIVES OF THE SUBJECT

(Section not available)
## STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>30.0</td>
<td>16.00</td>
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<tr>
<td>Hours large group</td>
<td>45.0</td>
<td>24.00</td>
</tr>
<tr>
<td>Self study</td>
<td>112.5</td>
<td>60.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 187.5 h

## CONTENTS

### 1. Plane and space curves

**Description:**

**Full-or-part-time:** 37h 30m
- Theory classes: 9h
- Laboratory classes: 6h
- Self study: 22h 30m

### 2. Surfaces

**Description:**

**Full-or-part-time:** 37h 30m
- Theory classes: 9h
- Laboratory classes: 6h
- Self study: 22h 30m

### 3. Gauss Curvature

**Description:**

**Full-or-part-time:** 37h 30m
- Theory classes: 9h
- Laboratory classes: 6h
- Self study: 22h 30m
4. Examples of surfaces

Description:

Full-or-part-time: 12h 30m
Theory classes: 3h
Laboratory classes: 2h
Self study: 7h 30m

5. Fundamental equations of surface theory

Description:

Full-or-part-time: 25h
Theory classes: 6h
Laboratory classes: 4h
Self study: 15h

6. Geometry on a surface

Description:
Covariant derivative and parallel transport. Geodesics, geodesic curvature, Liouville's formula. The exponential map, minimality properties of geodesics. Sums of the angles of a spherical triangle; Gauss-Bonnet's theorem and applications.

Full-or-part-time: 22h 30m
Theory classes: 5h
Laboratory classes: 4h
Self study: 13h 30m

7. Introduction to differential manifolds

Description:

Full-or-part-time: 15h
Theory classes: 4h
Laboratory classes: 2h
Self study: 9h
**GRADING SYSTEM**

The subject mark will be obtained from:

ME: Midterm Exam  
FE: Final Exam

by the following formula:

Final Mark = \( \max(\text{FE}, 0.3 \times \text{ME} + 0.7 \times \text{FE}) \).

An extra exam will take place on July for students that failed during the regular semester.

**EXAMINATION RULES.**

The exams (ME and FE) will contain theoretical and practical questions.

Only a formulary will be allowed.

**BIBLIOGRAPHY**

**Basic:**

**Complementary:**

**RESOURCES**

Other resources:
* Famous Curves Applet Index http://www-history.mcs.st-and.ac.uk/Java/  
* 3D-XplorMath, de Richard Palais: http://3d-xplormath.org/  
* Wolfram mathworld curves http://mathworld.wolfram.com/topics/Curves  
* National Curve bank http://curvebank.calstatela.edu/home/home.htm  
* Open Geometry Gallery http://www1.uni-ak.ac.at/geom/opegeometry_gallery  
* Virtual Math museum http://virtualmathmuseum.org/Surface/gallery_o  
* Wolfram mathworld surfaces http://mathworld.wolfram.com/topics/Surfaces  
* Other galleries: http://faculty.evansville.edu/ck6/GalleryTwo/Introduction2