

27041 - Differentiable Manifolds

Syllabus Information

Academic year: 2023/24

Subject: 27041 - Differentiable Manifolds

Faculty / School: 100 - Facultad de Ciencias

Degree: 453 - Degree in Mathematics

ECTS: 6.0

Year: 4

Semester: First semester

Subject type: Optional

Module:

1. General information

In this subject the notion of surface is generalized to spaces of dimension n . The goal is the study of the geometry of these spaces, known as differentiable manifolds, by means of the extension on them of results and tools from the analysis.

The approaches and objectives of this module are aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda; the learning activities could contribute to some extent to the achievement of the goals 4 (quality education), 5 (gender equality), 8 (decent work and economic growth), and 10 (reducing inequality).

2. Learning results

- Understand the notions of differentiable manifold and smooth map between manifolds.
- Be able to make computations in local coordinates.
- Recognize and construct new manifolds as submanifolds of other given manifolds.
- Determine properties of manifolds endowed with a metric and/or a group structure.

3. Syllabus

1. Differentiable manifolds.
2. Manifolds and smooth maps.
3. Topological properties of manifolds. Partitions of unity.
4. Tangent space. Differentiation on a manifold.
5. Submersions, immersions and embeddings.
6. Submanifolds.
7. Lie group actions.
8. Vector fields, integral curves and flows.
9. The Lie derivative.
10. One-parameter subgroups of a Lie group.
11. The exponential map.
12. The closed subgroup theorem.

4. Academic activities

Master classes: 45 hours.

Problem solving: 15 hours.

Project: 27 hours.

Study: 60 hours.

Assessment tests: 3 hours.

5. Assessment system

Along the course, the students are asked to solve different activities (mostly exercises and problems) and to give an oral presentation about a complementary subject related to the program of the course.

These activities (NC) correspond to the 70% of the final grade.

The other 30% will come from a written final exam (EF) after the end of the classes.

According to current bylaws, a student also has the right to show up to the final exam and complete the class upon passing the test.

Therefore, the final grade will be the greater of the following two quantities: (EF) and $0,7(NC)+0,3(EF)$.