27040 - Topology of Surfaces

Syllabus Information

Academic Year: 2019/20
Subject: 27040 - Topology of Surfaces
Faculty / School: 100 -

Degree: 453 - Degree in Mathematics

ECTS: 6.0
Year: 4
Semester: Second semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

This subject and its syllabus have the following goals:
Give the student a topological sense of the study and classification of surfaces. The notion of topological invariant, such as the fundamental group, is relevant to the study of mathematical objects. In this class, a particular topological invariant, having an algebraic structure (a group) will be able of determine the topological structure of compact surfaces, and even determine their orientability.

1.2.Context and importance of this course in the degree

This subject is part of the módulo Ampliación de Geometría y Topología (Higher Geometry and Topology)
As mentioned in section 1.1, it is recommended that the student is familiar with both algebraic and topological techniques, such as those provided in Algebra Lineal, Topología General, and Estructuras Algebraicas. This class will connect them considering certain topological invariants of an algebraic nature and applying them to solve concrete problems.

1.3.Recommendations to take this course

Students are recommended to have aquired the competences associated with the Fundamentos de Geometría y Topología (Fundamentals in Geometry and Topology), in particular Algebra Lineal, Topología General and Estructuras Algebraicas.

2.Learning goals

2.1.Competences

Upon succesfully completion of this subject the student will improve the following abilities...

Carry out the goals described in section 2.1

CG3. To have the ability to gather and interpret the relevant data, particularly in the field of Mathematics, in order to make statements using analytical methods as well as abstraction, containing insights on relevant topics, be it of a social, scientific, or ethical nature.

CG5: To develop learning skills that will be necessary to continue studies in Mathematics with a high degree of autonomy.

CT1. Be able to clearly state, both orally and in writing, the student's reasoning, problem solving techniques, reports, etc.

CE1. Understand and apply both mathematical language and methods. Learn rigorous proofs of the basic theorems in the different areas of Mathematics.

2.2.Learning goals

In order to pass this class, the student should be able to show the following skills...

Understand the notion of fundamental group and be able to compute it in some concrete situations.
Topologically recognize compact surfaces and classify them.

2.3.Importance of learning goals

The learning objectives provide basic skills within the Degree. (See Context and reasons behind the subject area in the Degree)

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that they have achived the learning objectives by means of the following evaluation activities:

After each chapter, students are asked to solve a problem and give an oral presentation on it in class. The total grade (A) of this part will add up to 60% of the total grade.

The remaining 40% will come from the grade (B) of the final exam.

In addition, according to current bylaws, a student also has the right to show up to a final exam and complete the class upon passing the test (B).

The final grade will be the maximum between (B) and 0,6(A)+0,4(B).

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving sessions, tutorials and autonomous work and study.

4.2.Learning tasks

This course is organized as follows:
- **Lectures**. Three weekly sessions.
- **Problem-solving sessions** in small groups. One weekly session. Oral presentations of problems.
- **Tutorials**.
- **Autonomous work and study**. In addition to the general teaching methodology activities students are afforded the opportunity to submit individual homework assignments on a weekly basis. These assignments are checked by the teacher and returned on a regular basis. This process allows students to pinpoint strengths/weaknesses and helps in their learning process.

4.3.Syllabus

This course will address the following topics:
- **Topic 1. Fundamental Group.**
  - Definition and Preliminaries.
  - Calculations of Fundamental Groups.
  - The Fundamental Group of the Circumference.
  - Seifert-Van Kampen Theorem.
- **Topic 2. Classification of Surfaces.**
  - Connected Sum. Surgery.
  - Triangulation. Euler Characteristic.
  - Classification Theorem.
- **Topic 3. Covering Spaces.**
  - Definition and Motivation.
  - Covering Spaces of Surfaces.
- **Topic 4. Introduction to knot theory.**

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

4.5.Bibliography and recommended resources

Basic Bibliography:
- Massey, William S.. Introducción a la topología algebraica / William S. Massey . Barcelona[etc.] : Reverté, cop.1982
- Armstrong, M.A.. Topología básica / M.A. Armstrong . Barcelona [etc.] : Reverté, D.L. 1987