



Qualitative theory of ordinary differential equations

Syllabus

Course code:	1611
Number of ECTS credits:	6
Semester:	2nd (February-June)
Prerequisites:	60 credits of basic courses and 60 credits of obligatory courses
Recommended components:	You should be familiar with linear algebra, topology of metric spaces, functions of several real variables and ordinary differential equations (1584)
Language of instruction:	Spanish

Course description

Carrying on with the previous course on Ordinary Differential Equations (code 1584), the goal of this course is to describe properties of the solutions of differential equations that can be deduced only of the fact that they are solutions, without knowing the explicit form of these solutions. The course represents an introduction to the fascinating theory of continuous dynamical systems.

Learning outcomes and competences

After completion of this course you will:

1. Understand the concept of continuous dynamical system and basic properties associated.
2. Be able to separate and classify different local behaviour at zero of solutions of a linear differential system.
3. Understand the different types of stability of a singular point and identify them in concrete equations.
4. Know how to apply different techniques to conclude the existence of periodic solutions in plane differential systems.

Course contents

I. Basic theory.

1. Summary of basic theory: existence, unicity, continuation and dependence on initial conditions.

2. Autonomous systems. Flows.

II. Linear differential equations

1. Constant coefficients. Sources and sinks: conjugation.
2. General theory of linear differential systems.

III. Local theory

1. Near a regular point: flow-box theorem.
2. Stability by linearization.
3. Stability by Lyapunov's direct method.

IV. Periodic orbits in the plane

1. Poincaré-Bendixson's theorem
2. Liénard's equations and other examples.

References

Main texts

1. M.W. Hirsch, S. Smale, "Ecuaciones diferenciales, sistemas dinámicos y álgebra lineal", Alianza Universidad Textos, 1983.
2. J. Sotomayor, Ecuaciones Diferenciais Ordinarias, IMPA.