UNIVERSIDAD DE MURCIA

FACULTY OF MATHEMATICS

Ordinary differential equations

Syllabus

Course code:	1584
Number of ECTS credits:	6
Semester:	2nd (February-June)
Prerequisites:	None
Recommended components:	Linear Algebra (1569); Real functions of one variable I, II (1568, 1573); Topology of metric spaces (1575)
Language of instruction:	Spanish

Course description

The present course can be viewed as the first contact with the subject of the differential equations, a relevant matter both for historical reasons and the great variety of modern applications.

We emphasize our analysis in the most simple class of differential equations, namely, ordinary differential equations (ODE), a type of functional equations where the unknown is a differentiable map depending on a unique independent variable.

Roughly speaking, we present the traditional methods of resolution of ODE, illustrating them with a wide collection of (applied) exercises, and we develop the classical theory on existence and unicity of solutions of ODE.

Learning outcomes and competences

After completion of this course you will:

1. know the geometric meaning of an ODE and to be able to distinguish different types of ODE's;
2. recognize the different approaches to the study and resolution of ODE's: explicitly, qualitative behaviour of the solutions and numerical resolution;
3. know and handle several examples related to models in terms of ODE's in the frame of Applied Sciences;
4. to learn the methods for solving by quadratures different types of first order differential equations;
5. to learn and apply the basic results on existence and uniqueness of ODE's;
6. to recognize and solve linear systems with constant coefficients and second order linear equations with variable coefficients, in particular by the use of analytical functions;
7. to analyze the prolongation of solutions and the dependence on parameters and initial conditions.

Course contents

I. Introduction.

II. Methods to solve ODE of first order. Applications.

III. Linear equations and linear systems. Applications.

IV. Theory of existence and uniqueness of solutions of ODE's. Prolongation. Dependence on parameters and initial values.

V. Solving linear equations by powers series. Cauchy's Theorem.

VI. Laplace's transform.

References

Main texts

1. A.K. Boiarchuk, G.P. Golovach, *Problemas resueltos de ecuaciones diferenciales. Volúmenes 8,9,10.* Editorial URSS (2002).

2. V. Jiménez López, *Ecuaciones Diferenciales: Cómo aprenderlas, cómo enseñarlas.* Sección de Publicaciones de la Universidad de Murcia (2000).

3. A. Linero Bas, *Ecuaciones diferenciales ordinarias: apuntes de clase.*

4. M. López Rodríguez, *Problemas resueltos de Ecuaciones Diferenciales.* Editorial Thomson (2007).

5. G.F. Simmons, *Ecuaciones Diferenciales con Aplicaciones y Notas Históricas.* Mc.Graw Hill (1993).

Supplementary references

1. M. Braun, *Differential Equations and their Applications.* Springer-Verlag (1993).

2. E. Coddington, N. Levinson, *Theory of Ordinary Differential Equations.* Mc Graw Hill (1955).

3. M. de Guzmán,*Ecuaciones Diferenciales Ordinarias. Teoría de la Estabilidad y del Control.* Alhambra (1975).

4. L. Elsgoltz, *Ecuaciones diferenciales y cálculo variacional.* Editorial Urss Moscú (1994).

5. A. Kiseliov, M. Krasnov, G. Makarenko, *Problemas de Ecuaciones Diferenciales.* Editorial Mir (1979).

6. C. Pita, *Ecuaciones Diferenciales. Una introducción con aplicaciones.* Ed. Limusa, MÃ©xico (1989).

7. D.G. Zill, *Ecuaciones diferenciales con aplicaciones de modelado.* Editorial Thomson (2007).