Escuela Técnica Superior de
Ingenieros de **Telecomunicación**

Advanced Mathematics (AM)			
Code number:	45005	Number of ECTS:	6 ECTS
Semester:	Autumn	Language:	English

Lecturer(s) and contact:

- Dr. Eduardo Cuesta Montero (eduardo@mat.uva.es)

Learning goals:

At the end of this sections, the student should be able to:

- Manage problems involving complex variable and vector calculus, and differential geometry.
- Solve analytically the most common partial differential equations in physic and engineering .
- Model mathematically a wide range of problems arisen in the degree.
- Discover the relationship between the subjects of the present course and other subjects, in fact the ones related to Telecommunication and Electronic Engineering.
- Use recommended bibliography to assess ideas and results.
- Understand further mathematical models related to Telecommunication and Electronic Engineering.

Contents:

1. CURVES AND SURFACES:
   Parametric curves, geometric curves, and orientation. Parametric surfaces, tangent plane, and orientation. Implicit's and Inverse's Theorem. Implicit curves and surfaces.

2. SCALAR AND VECTOR FIELDS:
   Gradient, equipotential varieties, curl, divergence, and Laplacian. Conservative fields, solenoidal fields, and potentials.

3. LINE INTEGRALS:
   Line integrals for scalar functions. Parametrizing with respect to arc length. Fields along curves. Green's Formula. Simply connected domains, and potentials.

4. SURFACE INTEGRALS:
   Integral in several variables. Surface integration of scalar functions. Parametric surface area. Field flux throughout a surface. Surfaces with oriented border. Stoke's Theorem. Gauss Theorem.

5. INTRODUCTION TO COMPLEX VARIABLE FUNCTIONS:
   Basic properties of complex numbers. Complex variable functions. Geometric representation of elementary functions.

6. HOLOMORPHIC FUNCTIONS:
   Limits and continuity. Holomorphic functions. Cauchy-Riemann's conditions. Geometrical meaning. Elementary holomorphic functions.

7. COMPLEX INTEGRATION:
   Definitions and properties. Relationship with the line integral. Cauchy's Integral Formula. Taylor expansions.

8. POWER EXPANSIONS:
   Sequences and series of complex numbers. Convergence of sequences and series of functions. Integration term by term. Power expansions. Convergence radius. Zero order. Taylor's expansions. Properties of functions defined by power expansions. Analytic functions.

9. LAURENT'S EXPANSIONS:
   Singularity classification. Development of Laurent's expansions.
10. FOURIER EXPANSIONS:
   Representation of functions in terms of Fourier expansions. Convergence and applications.
11. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS:
   Background in partial differential equations. Eigenvalue Problems and Fourier expansions.
12. SEPARATED VARIABLE METHOD FOR PARTIAL DIFFERENTIAL EQUATIONS:
   General problems statement. Applications to equations of physic mathematic.

Prerequisites:
Some background on Calculus and Linear Algebra is strongly recommended.