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Program	59EC – Communications Electronic Engineering B. Eng.
	59SC – Telecommunications Systems Engineering B. Eng.
	59SO – Sound and Image Engineering B.Eng.
	59TL – Telematics Engineering B. Eng.

Course code and name		
Code	595000003, 595000302, 595000102, 595000202	
Name	Calculus I	
Semester	S1 [(September-January)]	

	Credits and contact hours
ECTS Credits	6
Contact hours	60

Coordinator's name	López Salazar, Jerónimo [jeronimo.lopezsalazar@upm.es]
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Specific course information						
Tuition language	Spanish					
Description of course content						
The aim is to consolidate and give rigour to the knowledge of infinitesimal calculus that						
the student had acquir	the student had acquired in the secondary education: limits, continuity, derivability and					
integrability. New con	integrability. New concepts are also introduced such as differential equations, sequences					
and series of real numbers and series of functions.						
List of topics to be co	vered					
1. Real functions of re	al variable.					
1.1. Introductio	on to the real numbers.					
1.2. Limits and	continuity.					
1.3. Derivative	S.					
1.4. Rolle's the	corem. Theorem of the medium value.					
1.5. L'Hôpital's rule.						
1.6. Monotonicity, concavity and local extrema.						
1.7. Taylor's theorem.						
2. The Riemann Integral.						
2.1. Definition and properties.						
2.2. Fundamental Theorem of Calculus.						
2.4. Improper integrals.						
3. First order ordinary differential equations.						
3.1. Definition of differential equation.						
3.2. Separation of variables.						
3.3. Homogene	eous equation.					
3.4. Linear equ	ation.					



3.5. Bernoulli's equation.

4. Numerical series and sequences.

4.1. Limit to the sequences.

- 4.2. Monotone sequences.
- 4.3. Numerical series.
- 4.4. Telescoping and geometric series.
- 4.5. Series of positive terms. Convergence criterion.
- 4.6. Alternating series. Leibniz rule.
- 4.7. Absolutely convergent series.

5. Power series.

- 5.1. Convergence interval.
- 5.2. Integration and derivative.
- 5.3. Taylor series.
- 6. Fourier series.
 - 6.1. 2π -periodic function.
 - 6.2. Pairing and unpairing functions.
 - 6.3. Arbitrary function.

6.4. Dirichlet's.

Prerequisites or co-requisites

None

Course category in the program

☑ R (required)

□ E (elective)

(elective courses may not be offered every year)

Specific goals for the course

Specific outcomes of instruction

- RA1082 To know the concepts of continuity and derivative of a real variable and of the main related theorems.
- RA1085 To solve the basic examples of the ordinary differential equations.
- RA1100 To know the fundamental theorem of the Calculus.
- RA1088 To develop elementary functions in power series.
- RA1089 To develop periodic functions in Fourier series.
- RA1087 To analyze the convergence of numerical series.

Further reading and supplementary materials

- J. Burgos. Cálculo infinitesimal de una variable. McGraw-Hill. 2007.
- A. García, F. García, A. Gutiérrez, A. López, G. Rodríguez, A. Villa. Cálculo I.
- Teoría y problemas de Análisis Matemático en una variable. CLAGSA, 2007.
- R. Larson, B.H. Edwards. Cálculo I. McGraw Hill, 2010.
- S.L. Salas, E. Hille, G.J. Etgen. Calculus, vol. 1. Reverté, 2006.
- M. Spivak. Calculus. Reverté, 2012.