Course guide
230001 - CAL - Calculus

Unit in charge:	Barcelona School of Telecommunications Engineering
Teaching unit:	749 - MAT - Department of Mathematics.

Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2024   **ECTS Credits:** 6.0   **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	FRANCISCO JAVIER MUÑOZ LOPEZ
Others:	Primer quadrimestre: FATIMA EZZAHRA LEMBARKI EL AMMARI - 50 AMANDA MONTEJANO CANTORAL - 30 ALVARO MOZOTA FRAUCA - 20 FRANCISCO JAVIER MUÑOZ LOPEZ - 10 ALBA TACORONTE HERNANDEZ - 40 Segon quadrimestre: FATIMA EZZAHRA LEMBARKI EL AMMARI - 40 ALBA TACORONTE HERNANDEZ - 10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:
12 CPE N1. They will be able to identify, formulate and solve engineering problems in the ICC field and will know how to develop a method for analysing and solving problems that is systematic, critical and creative.

TEACHING METHODOLOGY

Problem solving classes
On campus lessons
Individual work (no face to face lessons)
Short answer controls and homework
Final exam (long answer exam)

LEARNING OBJECTIVES OF THE SUBJECT

Achieving sufficient level of one variable Calculus to deal with, or to base the treatment of phenomena that can be described in these terms. Also support of parties other subjects that require mastery of real functions of one variable. Introduction to functions defined by series, the Laplace Transform and its use to solve elemental differential equations and system of differential equations.

Learning outcomes:

Clearly expresses the process of planning and problem solving, and problems that require the use of calculus of one variable.
Comprehend and dominates the most useful methods for solving problems in the field of one variable.
He/she is able to confront the equations and numerical description of problems with descriptive statement.
He/she uses more than one source, and uses it as complementary to observe the events described in the main text.
Identifies problems and models from open situations. Study alternatives for their resolution.

STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	65,0	43.33

Total learning time: 150 h

CONTENTS

Unit 1. Real numbers and sequences

Description:
Insufficiency of rational numbers.
Notions of topology.
Real numbers. properties
Sequences of real numbers. Limits and convergence. Indeterminacy.

Full-or-part-time: 22h
Theory classes: 10h
Self study : 12h

Unit 3. Functions. Continuity and Diferentiation

Description:
Domain and Range. Injective, surjective and bijective functions. Inverse function
Elementary functions. Polynomials, FAT and factorization. Trigonometric, hyperbolic, exponential and logarithmic functions.
Limit of a function at a point. Continuity Types of discontinuities.
Bolzano and Weierstrass Theorems.
Derivative of a function at a point.
function derivative. Algebra of derivatives. Chain rule.
Derivation of the inverse function.

Full-or-part-time: 28h
Theory classes: 13h
Self study : 15h

Unit 4. Differentiation theorems,

Description:
Rolle, Lagrange and Cauchy Theorems.
L'Hôpital theorem.
Infinitesimals and infinites. Orders of magnitude. Landau notation.
Taylor's theorem. Polynomials of elementary functions. Applications to the computation of limits.
Local sudy of functions. Graphical representation of functions.

Full-or-part-time: 28h
Theory classes: 13h
Self study : 15h

Unit 4. Integrals and Primitives

Description:
Riemann integral. Integrability.
properties Mean value theorem.
Fundamental theorem of Calculus. Barrow's rule.
Theorem of Change of variables.
Integration by parts.
Integration of rational functions.
Calculation of areas.

Full-or-part-time: 28h
Theory classes: 12h
Self study : 16h

Unit 11. Improper integrals ans Series

Description:
Improper integrals of the first, second and third kind.
Absolute convergence. Convergence criteria.
Numerical series. Convergence Absolute convergence.
Convergence criteria. Alternate series.
Power series. Convergence radius and convergence interval.
Taylor series and sums of series.

Full-or-part-time: 25h
Theory classes: 12h
Self study : 13h

ACTIVITIES

FINAL EXAMEN

Description:
Final exam

Full-or-part-time: 3h
Theory classes: 3h

CONTROL

Description:
Short answer controls

Full-or-part-time: 3h
Theory classes: 3h

GRADING SYSTEM

Kind of exams to do and weight on the final evaluation:

Final exam: 60%
Continuous evaluation: 40%

On this subject will be evaluated the degree competences:

-Self-directed learning (Elementary level)
-Ability to identify, formulate and solve engineering problems (Elementary level)

EXAMINATION RULES.

The standard ones for this kind of controls

BIBLIOGRAPHY

Basic:
- Spivak, M. Calculus [on line]. 3a. ed. Barcelona: Reverte, 2012 [Consultation: 04/05/2020]. Available on:
http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8018. ISBN 9788429151824.
- Gracia, I.; Padró, C. Apunts de teoria per a l'assignatura de càlcul. (Atenea) [on line]. [Consultation: 13/05/2020]. Available on:
https://atenea.upc.edu/login/index.php.
- Aroca, Josep Maria. Càlcul infinitesimal: notes de classe [on line]. Barcelona: Departament de Matemàtica Aplicada IV, Universitat Politècnica de Catalunya, 2014 [Consultation: 23/10/2014]. Available on:
https://web.mat.upc.edu/josep.m.aroca/calcul/calcul-apunts-jmaroca.pdf.
- Aguiló, F. [et al.]. Aprenentatge de càlcul [on line]. Barcelona: Edicions UPC, 2002 [Consultation: 28/04/2020]. Available on:
http://hdl.handle.net/2099.3/36227. ISBN 8483016311.

Complementary:
- Professors de l'assignatura. Col·lecció d'exercicis de càlcul. (Atenea) [on line]. 2009 [Consultation: 14/05/2020]. Available on:
https://atenea.upc.edu/login/index.php.
- Baranenkov, G.; Demidovich, B. P. Problemas y ejercicios de análisis matemático. Madrid: Paraninfo, 1969. ISBN 8428300496.
- Spivak, M. Answer book for calculus. 3rd. ed. Publish or Perish, ISBN 9780914098904.