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230001 - CAL - Calculus

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 749 - MAT - Department of Mathematics

Academic year: 2019

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: JORGE JIMENEZ URROZ

Others: Aguiló Gost, Francisco
Aroca Farrerons, Josep M.
Gracia Rivas, Ignacio
Gràcia Sabaté, Xavier
Jiménez Urroz, Jorge
Martín Molleví, Sebastià
Padró Laimón, Carles
Sáez Moreno, Germán

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.

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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

Total learning time: 150h	Hours large group:	65h	43.33%
	Self study:	85h	56.67%

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Content

Unit 1. Real numbers

Learning time: 11h 30m

Theory classes: 5h
Self study : 6h 30m

Description:
Real numbers. Properties of numbers . Inequalities. Absolute value. Natural numbers and the principle of induction.
Supreme, infimum and the field of real numbers. The real line . Intervals .

Complex numbers

Learning time: 6h 54m

Theory classes: 3h
Self study : 3h 54m

Description:
Definition and properties. Real and imaginary parts, magnitude and angle . Conjugate . Euler's formula . binomial representation, polar, exponential. Moivre's formula . Roots and
Powers of complex numbers.

Unit 3. Functions

Learning time: 16h 06m

Theory classes: 7h
Self study : 9h 06m

Description:
Definition and first examples . Operations between functions. Domain and range . Intervals . Injective , exhaustive, function
bijective and inverse function. Elementary functions. Polynomials and factoring TFA . Trigonometric , hyperbolic , exponential and logarithm . Function graphs.

Unit 4. Function limits

Learning time: 16h 06m

Theory classes: 7h
Self study : 9h 06m

Description:
Limit of a function at a point . infinite limits . limits at infinity. Properties of the limit , algebra of infinit limits. lateral limits . Uncertainties : infinite / infinite (rational functions) infinity - infinity (diference of roots or logarithms), 1 ^ infinity (number e)

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Unit 5. Continuity

Learning time: 9h 21m

Theory classes: 4h
Self study : 5h 21m

Description:
Continuous functions , definition and properties . Type of discontinuity . Bounds, maximum and minimum . Weierstrass theorem . Bolzano theorem . Mean value theorem .

Unit 6. Differentiability

Learning time: 16h 06m

Theory classes: 7h
Self study : 9h 06m

Description:
Derivative of a function at a point , derivative function . Tangent line . Derived of elementary functions. Properties of the derivative (Leibnitz chain rule , inverse function) . Rolle theorem . Mean value theorems . L' Hopital Theorem and application to computation of limits.
infinitesimals and infinits.

Unit 7. Taylor polynomials

Learning time: 11h 30m

Theory classes: 5h
Self study : 6h 30m

Description:
Contact order . Taylor polynomials of a function . Taylor residue . Taylor formula .
Taylor polynomials of elementary functions. Properties Taylor polynomials .
Applications: estimates , calculations of limits.

Unit 8. Local study of functions

Learning time: 9h 12m

Theory classes: 4h
Self study : 5h 12m

Description:
Increasing and decreasing. Local extrema . Concavity and convexity. Inflection points .
Characterization from the signs of the derivatives. Asymptotes . Graphs study of functions.

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Unit 9. Primitives

Learning time: 16h 06m
Theory classes: 7h
Self study : 9h 06m

Description:
Definition. Calculation of immediate primitives, by parts and using change of variable. Calculation of rational primitives, trigonometric and irrational.

Unit 10. Riemann's Integral

Learning time: 9h 12m
Theory classes: 4h
Self study : 5h 12m

Description:
Definition of Riemann integral . Properties. Fundamental Theorem of Calculus . Applications of the definite integral

Unit 11. Indefinite integrals.

Learning time: 9h 12m
Theory classes: 4h
Self study : 5h 12m

Description:
Locally integrable functions . Improper integrals of the first kind . improper integrals the second kind . Convergence criteria. Absolute convergence . Euler gamma function.

Unit 12. Series of numbers and power series

Learning time: 13h 48m
Theory classes: 6h
Self study : 7h 48m

Description:
Sequences. Numerical series. Examples (geometric , harmonics) . Convergence criteria (comparison, root ratio , integral) . Alternating series . Absolute convergence . Power series . Radio and interval of convergence.
Derivation and integration of functions defined by power series.
Taylor series .

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Planning of activities

FINAL EXAMEN	Hours: 3h Theory classes: 3h
Description: Final exam	

CONTROL	Hours: 3h Theory classes: 3h
Description: Short answer controls	

Qualification 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)

Regulations for carrying out activities

The standard ones for this kind of controls

Bibliography

Basic:

Spivak, M. Calculus. 3a. ed. Barcelona: Reverte, 2012. ISBN 9788429151824.

Gracia, I.; Padró, C. Apunts de teoria per a l'assignatura de càlcul. (Atenea).

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: <www-ma4.upc.edu/~aroca/calcul/calcul-apunts-jmaroca.pdf>.

Aguiló, F. [et al.]. Aprenentatge de càlcul [on line]. Barcelona: Edicions UPC, 2002 [Consultation: 04/03/2015]. Available on: <http://hdl.handle.net/2099.3/36227>. ISBN 8483016311.

Complementary:

Professors de l'assignatura. Col·lecció d'exercicis de càlcul. (Atenea). 2009.

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.