

230083 - CAVEC - Vector 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)		
ECTS credits:	6	Teaching languages:	Catalan

Teaching staff

Coordinator:	Martin De La Torre, Pablo
Others:	Martin De La Torre, Pablo Gracia Rivas, Ignacio

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.

Learning objectives of the subject

To begin with, the concepts introduced in Càlcul 1 about functions of one real variable are generalized to several variables. More concretely, the differentiability of functions, the integration of functions and their applications as, for example, to the optimization problems.

The basic concepts of differential geometry of curves and surfaces, in the plane and in the space, are introduced with the aim to study the fundamental theorems of vectorial integration: Green's, Stokes and Gauss theorems, basics in the study of electromagnetic fields.

Study load

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

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Content

<p>Topology of the n-dimensional real space</p>	<p>Learning time: 16h Theory classes: 7h Self study : 9h</p>
<p>Description: The n-dimensional euclidean space. Euclidian distance. Balls. Interior, exterior and border of a set. Accumulation points. Open and closed sets and their properties. Bounded sets. Bolzano Weierstras theorem. Cauchy and convergent sequences.</p>	
<p>Functions of several variables</p>	<p>Learning time: 14h Theory classes: 6h Self study : 8h</p>
<p>Description: Scalar and vector functions. Graphic and level sets. Composition of functions. Limits: definitions, properties. Computation of limits. Direccional limits. Continuity: definition and properties. Weierstrass theorem. Arc-connected sets.</p>	
<p>Differentiability and local extrema</p>	<p>Learning time: 35h Theory classes: 15h Self study : 20h</p>
<p>Description: Definition of differentiability. Jacobian matrix. Direccional derivatives. Gradient. Chain rule. Functions of class C^1. Derivation of the inverse function. Derivation of the implicit function. Changes of variables. Polar, cilindrical and spherical coordinates. Differential operators: curl and divergence. Derivatives of higher order. Schwarz theorem. Hessian matrix and Taylor formula of degree 2. Local extrema. Critical points. Saddle points. Eigenvalues criterium. Sylvester criterium.</p>	
<p>Curves and surfaces</p>	<p>Learning time: 24h Theory classes: 10h Self study : 14h</p>
<p>Description: Regular parametrization of curves and surfaces. Geometrical applications. Curves and surfaces defined implicitly. Computation of restricted maxima and minima. Lagrange multipliers. Optimization: absolut maxima and minima.</p>	

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Multiple integration	Learning time: 24h Theory classes: 10h Self study : 14h
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Description: Definition and properties. Mesurable sets and sufficient and necessary condition for integrability. Fubini's theorem. Geometrical applications. Change of variables. Leibniz formula. Improper integrals.	
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Line and surface integrals	Learning time: 35h Theory classes: 15h Self study : 20h
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Description: Line and surface integrals of a scalar function. Geometrical applications. Circulation and flux of a vector field. Path independence. Conservative fields. Computation of the scalar potential. Simple and multiple connected sets. Green's and Stokes theorems. Solenoidal vector fields. Computation of the vector potential. Gauss theorem.	
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Qualification system

Evaluation: continuous, along the term, with a 40% weight, and a final test, with a 60% weight.

Bibliography

Basic:

Marsden, Jerrold E; Tromba, Anthony. Cálculo vectorial [on line]. 6a ed. Madrid [etc.]: Addison Wesley, 2018 [Consultation: 21/09/2018]. Available on: <http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=7634>. ISBN 9788490355787.

Complementary:

Apostol, Tom M. Calculus. 2a. ed. Barcelona [etc.]: Reverté, 1972. ISBN 8429150013.

Marsden, Jerrold E; Tromba, Anthony. Cálculo vectorial : problemas resueltos. 3ª ed. Argentina [etc.]: Addison-Wesley Iberoamericana, 1993. ISBN 0201625644.

Spiegel, Murray R. Cálculo superior. México [etc.]: McGraw-Hill, 1969. ISBN 8485240663.

Bombal Gordon, Fernando; Rodríguez Marín, Luis; Vera Botí, Gabriel. Problemas de análisis matemático. 2a ed. Madrid: AC, 1987-1988. ISBN 8472881024.

Spiegel, Murray R.; Lipschutz, Seymour. ; Liu, John. Fórmulas y tablas de matemática aplicada. 4a ed. Madrid [etc.]: McGraw-Hill, 2014. ISBN 9786071511454.