

270205 - AC2 - Advanced Algebra and Calculus

Coordinating unit: 270 - FIB - Barcelona School of Informatics
 Teaching unit: 749 - MAT - Department of Mathematics
 Academic year: 2019
 Degree: BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
 ECTS credits: 7,5 Teaching languages: Catalan, Spanish, English

Degree competences to which the subject contributes

Basic:

CB1. That students have demonstrated to possess and understand knowledge in an area of ??study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply Knowledge from the vanguard of their field of study.

Specific:

CE1. Skillfully use mathematical concepts and methods that underlie the problems of science and data engineering.

Generical:

CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.

CG5. To be able to draw on fundamental knowledge and sound work methodologies acquired during the studies to adapt to the new technological scenarios of the future.

Transversal:

CT5. Solvent use of information resources. Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty and critically evaluate the results of such management.

CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

Teaching methodology

Teaching methodology is described in Activities

Learning objectives of the subject

Study load

Total learning time: 187h 30m	Theory classes:	45h	24.00%
	Laboratory classes:	30h	16.00%
	Guided activities:	0h	0.00%
	Self study:	112h 30m	60.00%

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Content

(ENG) Integració Múltiple

Degree competences to which the content contributes:

Description:

(ENG) Integral de Riemann de funcions de varies variables. Rectangles; recintes arbitraris; integrals impròpies. Teorema de Fubini. Integrals iterades. Recintes normals. Teorema del canvi de variable. Coordenades polars i esfèriques. Mètodes numèrics. Quadratures. Mètode de Monte Carlo.

Related activities:

(ENG)

Specific objectives:

(ENG) Sèries i transformada de Fourier

Degree competences to which the content contributes:

Description:

(ENG) Sèries de Fourier trigonomètriques i exponencials. Paritat. Transformada de Fourier. Propietats: simetries, desplaçament, escalat, convolució, conservació de la energia. Transformada de temps discret. Transformada discreta. Analogies i aplicacions. Altres transformades.

Related activities:

(ENG)

Specific objectives:

(ENG) Formes quadràtiques i extrems

Degree competences to which the content contributes:

Description:

(ENG) Formes quadràtiques i matrius simètriques. Definides, indefinides i semidefinides. Diagonalització. Signatura. Extrems de funcions de varies variables. Punts crítics. Matriu Hessiana. Extrems condicionats. Multiplicadors de Lagrange.

Related activities:

(ENG)

Specific objectives:

(ENG) Geometria Afí

Degree competences to which the content contributes:

Description:

(ENG) Espai afí. Sistemes de referència. Coordenades afins i baricèntriques. Varietats afins i les seves equacions. Paral·lelisme. Afinitats. Punts fixos i subvariantats invariants. Translació, homotècia, projecció, simetria.

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Related activities:
(ENG)

Specific objectives:

(ENG) Geometria Euclidiana

Degree competences to which the content contributes:

Description:

(ENG) Espai afí Euclidià. Orientació. Distància. Ortogonalitat. Volum. Projecció ortogonal. Isometries lineals i afins. Moviments rígids. Classificació i caracterització dels moviments en dimensió 2 i 3. Teorema espectral en dimensió arbitrària.

Related activities:
(ENG)

Specific objectives:

(ENG) Aproximació i Mínims Quadrats

Degree competences to which the content contributes:

Description:

(ENG) Interpolació: polinomi interpolador; splines; splines cúbiques. Ajust: regressió; mínims quadrats; components principals.

Related activities:
(ENG)

Specific objectives:

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Planning of activities

<p>(ENG) Desenvolupament del tema 1 de l'assignatura</p>	<p>Hours: 35h Theory classes: 9h Practical classes: 0h Laboratory classes: 6h Guided activities: 0h Self study: 20h</p>
<p>Description: (ENG) Classes de Teoria i Laboratori del tema1</p> <p>Support materials: (ENG)</p> <p>Descriptions of the assignments due and their relation to the assessment: (ENG)</p> <p>Specific objectives: (ENG) 1, 2, 3</p>	
<p>(ENG) Desenvolupament del tema 2 de l'assignatura</p>	<p>Hours: 15h Theory classes: 4h Practical classes: 0h Laboratory classes: 2h Guided activities: 0h Self study: 9h</p>
<p>Description: (ENG) Classes de Teoria i Laboratori del tema1</p> <p>Support materials: (ENG)</p> <p>Descriptions of the assignments due and their relation to the assessment: (ENG)</p> <p>Specific objectives: (ENG) 1, 2, 3</p>	
<p>(ENG) Desenvolupament del tema 3 de l'assignatura</p>	<p>Hours: 38h Theory classes: 9h Practical classes: 0h Laboratory classes: 6h Guided activities: 0h Self study: 23h</p>
<p>Description: (ENG) Classes de Teoria i Laboratori del tema3</p> <p>Support materials: (ENG)</p>	

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Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 1, 2, 3

(ENG) Desenvolupament del tema 4 de l'assignatura

Hours: 38h 30m
Theory classes: 9h
Practical classes: 0h
Laboratory classes: 6h
Guided activities: 0h
Self study: 23h 30m

Description:
(ENG) Classes de Teoria i Laboratori del tema 4

Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 1, 2, 3

(ENG) Desenvolupament del tema 5 de l'assignatura

Hours: 61h
Theory classes: 14h
Practical classes: 0h
Laboratory classes: 10h
Guided activities: 0h
Self study: 37h

Description:
(ENG) Classes de Teoria i Laboratori del tema 5

Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 1, 2, 3

Qualification system

Not yet translated

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Bibliography

Basic:

Marsden, Jerrold; Tromba, Anthony J. Vector calculus. 6th ed. W.H.Freeman, 2012. ISBN 9781429224048.

Chapra, Steven; Canale, Raymond. Numerical methods for engineers. 6th. McGraw-Hill, 2010. ISBN 9780073401065.

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Gallier, Jean; Quaintance, Jocelyn. Algebra, topology, differential calculus, and optimization theory for computer science and engineering [on line]. University of Pennsylvania. Department of Computer and Information Science, 2018 Available on: <<https://www.cis.upenn.edu/~jean/math-basics.pdf>>.

Brigham, E. Oran. The fast Fourier transform and its applications. Prentice-Hall, 1988. ISBN 0133075052.

Complementary:

Le Roux, Brigitte; Rouanet, Henri. Geometric data analysis [on line]. Kluwer academic publishers, 2005 Available on: <<http://dx.doi.org/10.1007/1-4020-2236-0>>. ISBN 1402022352.

McKay, David. Information theory, inference and learning algorithms. Cambridge University Press, 2003. ISBN 9780521642989.

Zorich, Vladimir A. Mathematical analysis II. 2nd ed. Springer, 2016. ISBN 9783662489932.

Blum, Avrim; Hopcroft, John; Kannan, Ravindran. Foundations of data science [on line]. 2018 Available on: <<https://www.cs.cornell.edu/jeh/book.pdf>>.

Hoggar, S.G. Mathematics of digital images : creation, compression, restoration, recognition. Cambridge university press, 2006. ISBN 0521780292.