Last update: 10-07-2017

820008 - ACM - Algebra and Multivariable Calculus

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering

Teaching unit: 749 - MAT - Department of Mathematics

Academic year: 2017

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
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BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: Ikhouane, Fayçal
Carmona Mejias, Ángeles

Others: MAT/EEBE

Opening hours

Timetable: Each teacher will determine the timetable when the course start.

Degree competences to which the subject contributes

Specific:

1. Solve mathematical problems that may arise in engineering. Apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation.

Transversal:

3. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Teaching methodology

Teaching methodology is a combination of lectures in the classroom and homeworks, along with a midterm and a final exam.

Learning objectives of the subject

To present the fundamental concepts of differential and integral calculus of several variables, and linear algebra. To develop the ability to applying them to engineering problems.

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Study load

Total learning time: 150h	Hours large group:	60h	40.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

(ENG) Linear algebra and geometry

Learning time: 40h

Theory classes: 16h
Self study : 24h

Description:
Vectors spaces. Linear combinations. Subspaces. Bases. Dimension. Linear mappings: definition and properties. Change of basis. Eigenvalues and eigenvectors. Characteristic polynomial. Diagonalization.

Specific objectives:
Identify and characterize vector spaces and subspaces, and manipulate vectors. Identify diagonalizable endomorphisms.

(ENG) Functions of several variables

Learning time: 30h

Theory classes: 12h
Self study : 18h

Description:
Vector-valued and scalar-valued functions. Topology. Limit and continuity. Directional and partial derivative. Differentiable functions, Jacobian matrix. Chain rule. Higher order derivative. Taylor's expansion theorem for functions of several variables.

Specific objectives:
Study of functions of several variables with emphasis on the concepts and methods of differential calculus of several variables.

(ENG) -Extrema of real functions of several variable

Learning time: 15h

Theory classes: 6h
Self study : 9h

Description:
Local and global extrema. Test for local extrema. Constrained extrema. Lagrange multiplier method.

Specific objectives:
To acquire the basic tools for analyzing extrema problems, both free and constrained extrema problems.

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(ENG) -Multiple integration and applications	Learning time: 30h Theory classes: 12h Self study : 18h

Description:
Double integral: definition and properties. Change of variables for double integrals. Triple integral: definition and properties. Change of variables for triple integrals. Applications for the double and triple integral: volume computations, center of mass and moments of inertia.

Specific objectives:
Ability for solving problems of multiple integration and its application to problems of science and engineering.

(ENG) Differential geometry and field theory	Learning time: 35h Theory classes: 14h Self study : 21h

Description:
Parametrized curves. Vector fields and scalar fields. Operators: gradient, divergence and curl. Conservative vector field and its associated potential function. Line integral. Green's theorem. Surface integral. Divergence and Stoke's theorems.

Specific objectives:
Ability to provide analytical descriptions of curves and surfaces, calculate their properties and perform differential and integral calculus operations on them. Applications in field theory.

Qualification system

The evaluation will be conducted through the assessment by the teacher. Students can pass the subject through continuous assessment based on exams and performing exercises. The objective of 'Self-Learning ' will be evaluated with a weight of 5 %.

Two exams will be administered during the quarter, P1 with weigth 40% and P2 with weight 40%
Learning Objective (LO): 5%
Problems/Controls/Solving problems: 15%

The grade is calculated as follows:

P1*40% + P2*40% + LO*5% + Homeworks*15%

Students that failed ordinary evaluation and have been regularly attending tests throughout the course will have the option to perform a re-evaluation test during the period specified in the academic calendar.

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Bibliography

Basic:

Marsden, J. E.; Tromba, A. J. Cálculo vectorial. 5ª ed. Madrid: Addison Wesley, 2004. ISBN 84-7829-069-9.

Arias, I. Cálculo avanzado para ingeniería : teoría, problemas resueltos y aplicaciones [on line]. Barcelona: Edicions UPC, 2008Available on: <http://upcommons.upc.edu/llibres/handle/2099.3/36849>. ISBN 9788483017609.

Dineen, S. Multivariate calculus and geometry. 2nd ed. London [etc.]: Springer, 2001. ISBN 1-8523-3472-X.

Larson, R.; Hostetler, R. P.; Edwards, B. H. Cálculo. 8ª ed. Madrid [etc.]: McGraw-Hill, 2006. ISBN 970-10-5274-9.

Grossman, S. I. Álgebra lineal. 6ª ed. México D.F. [etc.]: Mc Graw-Hill, cop. 2008. ISBN 9789701065174.

Marsden, J. E; Tromba, A. Vector calculus. 6th ed. New York: Freeman and Co., cop. 2012. ISBN 9781429224048.

Rogawski, J. Cálculo. 2a ed. Barcelona [etc.]: Reverté, cop. 2012. ISBN 9788429151664.

Zill, D. G.; Wright, W. S.; Cullen, M. R. Matemáticas avanzadas para ingeniería. 4ª ed. México [etc.]: McGraw-Hill, cop. 2012. ISBN 978-607-15-0772-3.

Complementary:

Kreyszig, E. Matemáticas avanzadas para ingeniería. 3a. México, D.F. [etc.]: Limusa, 2000. ISBN 978-968-18-5310-5.

Castellet, M.; Llerena, I. Àlgebra lineal i geometria. 4a ed. Bellaterra: Universitat Autònoma de Barcelona. Servei de Publicacions, 2000. ISBN 847488943X.

Alsina, C.; Trillas, E. Lecciones de álgebra y geometría : curso para estudiantes de arquitectura. 2ª ed. Barcelona: Gustavo Gili, 1984. ISBN 8425211875.