

820008 - ACM - Algebra and Multivariable Calculus

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

Teaching unit: 749 - MAT - Department of Mathematics

Academic year: 2019

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)
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 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: FAYÇAL IKHOUANE EL MOUSTACHIR - MARGARIDA MITJANA RIERA

Others: Primer quadrimestre:
ANGELES CARMONA MEJIAS - M30
FAYÇAL IKHOUANE EL MOUSTACHIR - T10, T20
MARGARIDA MITJANA RIERA - M10
JUAN TRIAS PAIRO - M20

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.

820008 - ACM - Algebra and Multivariable Calculus

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.

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%

820008 - ACM - Algebra and Multivariable Calculus

Content

<p>(ENG) Linear algebra and geometry</p>	<p>Learning time: 40h Theory classes: 16h Self study : 24h</p>
<p>Description: Vectors spaces. Linear combinations. Subspaces. Bases. Dimension. Linear mappings: definition and properties. Change of basis. Eigenvalues and eigenvectors. Characteristic polynomial. Diagonalization.</p> <p>Specific objectives: Identify and characterize vector spaces and subspaces, and manipulate vectors. Identify diagonalizable endomorphisms.</p>	
<p>(ENG) Functions of several variables</p>	<p>Learning time: 30h Theory classes: 12h Self study : 18h</p>
<p>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.</p> <p>Specific objectives: Study of functions of several variables with emphasis on the concepts and methods of differential calculus of several variables.</p>	
<p>(ENG) -Extrema of real functions of several variable</p>	<p>Learning time: 15h Theory classes: 6h Self study : 9h</p>
<p>Description: Local and global extrema. Test for local extrema. Constrained extrema. Lagrange multiplier method.</p> <p>Specific objectives: To acquire the basic tools for analyzing extrema problems, both free and constrained extrema problems.</p>	

820008 - ACM - Algebra and Multivariable Calculus

(ENG) -Multiple integration and applications	Learning time: 30h Theory classes: 12h Self study : 18h
<p>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.</p> <p>Specific objectives: Ability for solving problems of multiple integration and its application to problems of science and engineering.</p>	

(ENG) Differential geometry and field theory	Learning time: 35h Theory classes: 14h Self study : 21h
<p>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.</p> <p>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.</p>	

Qualification system

The grading will be carried out by means of the assessment by the teacher. The students should pass the subject with the continuous assessment based on the controls and the realization of exercises that will be common for all students.

Examens:

Exam 1 (20%) (Test plus a problem)

Exam 2 (20%) (Exam by pairs. The use of a calculator/computer/tablet...is allowed)

Exam 3 (20%) (Test plus a problem)

Exam 4 (40%) (Test plus two problems)

The subject DOES NOT HAVE a resit test .

It is recommended to consult the general regulation of evaluation of the EEBE

(<https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf>)

Regulations for carrying out activities

During the exams, the use of calculators, mobiles, PC's or tablets is not allowed, except for Exam 2. Students will be provided with a form that will be the only material that can be used during exams.

820008 - ACM - Algebra and Multivariable Calculus

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, 2008. Available on: <<http://upcommons.upc.edu/lilibreres/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. Álgebra 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.