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390104 - FM1 - Mathematics I

Coordinating unit: 390 - ESAB - Barcelona School of Agricultural Engineering

Teaching unit: 749 - MAT - Department of Mathematics

Academic year: 2019

Degree: BACHELOR ' S DEGREE IN AGRONOMIC SCIENCE ENGINEERING (Syllabus 2018). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AGRICULTURAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AGRICULTURAL, ENVIRONMENTAL AND LANDSCAPE ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Fabregat Fillet, Jaime

Others: Fabregat Fillet, Jaime
Garcia Martinez, Yamila
Montoro Lopez, Maria Eulalia

Degree competences to which the subject contributes

Specific:

2. Fundamentals of computer use and programming, operating systems, data bases, software for engineering applications.
3. Ability to solve mathematic problems in an engineering context . Ability to apply the knowledge of linear algebra, geometry, differential geometry, differential and integral calculus.

Generical:

1. Ability to solve problems.

Teaching methodology

The lecture and the participatory expositive class will be used, in particular, in sessions of two hours and one hour. The structured topics will be presented through the lecture, in order to facilitate the information organized according to the criteria that are appropriate for the objectives. By using the participatory expositive class, spaces will be incorporated for the intervention of students with short-term actions in the classroom (direct questions, student's exhibitions on specific topics, performance of exercises, problem solving linked to the theoretical approaches).
The resolution of exercises and problems with active involvement of students will be applied fundamentally in small groups and computer laboratories. Students will be asked during these sessions to seek appropriate solutions through the exercise of routines and the application of formulas or algorithms (although without losing the use of personal wits), the application of procedures for transforming the available information and the interpretation of the results, as well as the use of appropriate software, to be developed in a framework of computer lab practices.
Autonomous learning will focus on actions basically dedicated to solving exercises and problems. In the virtual campus some questionnaires related to various contents will be proposed to contribute to personal learning.

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Learning objectives of the subject

The subject Mathematics 1 will attend general training purposes, focusing the objectives on the generation of capacities for the learning and to foment attitudes of valuation of the power and utility of the mathematical models and procedures to understand, and to make decisions, inside the techno-scientific field. Mathematics will play an instrument role for a better approach to the technological and scientific environment and to be able to move on to it in a more autonomous and creative way. The systematic and ordered work, perseverance, deepening in interpretations, precision in reasoning, abstraction - which are some of the common characters of work in the area of ¿¿mathematics - will impregnate the teaching process. From a general point of view, the student must be able, within the framework of the contents of the subject, to exercise logical reasoning, develop analytical thinking, apply a critical spirit, methodically argue, communicate with rigor.
In the field of linear algebra, the student will assimilate fundamental concepts about linear relationships between variables, use basic tools and methods to solve exercises linked to these relationships, and work with concepts related to the sets on which optimizations of linear functions act when variables are linearly restricted. The student will deal with elementary aspects of analytical and differential geometry. In the field of differential calculus, the student will generalize previously assimilated concepts in the case of functions from one variable to functions of several variables, delimit properties of these using those of them, approximate functions through polynomial functions, and determine extrems. These competences will be applied fundamentally within the n-dimensional space (especially for n = 1, 2,3), and above all with functions that in their domain of definition (or in the interior of their domain) are infinitely derivable. Regarding the introduction of computer science, the student will know a powerful software as a work tool for solving many of the problems raised in the mathematical fields that are treated in the subject

Study load

Total learning time: 150h	Hours large group:	40h	26.67%
	Hours medium group:	0h	0.00%
	Hours small group:	20h	13.33%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

REAL MULTIVARIABLE FUNCTIONS

Learning time: 18h 45m

Theory classes: 5h
Practical classes: 2h 30m
Self study : 11h 15m

Description:
Introduction (basic definitions, domains ...). Explicit and implicit functions. Elementary functions (combinations of polynomials, roots and exponential, logarithmic, trigonometric, cyclometric functions). Functions defined in sections. Limits (iterated, directional ...). Continuity (at a point, in a set, domain). Derivation (partial, domain). Level curves. Tangency

VECTOR FUNCTIONS OF ONE VARIABLE

Learning time: 18h 45m

Theory classes: 7h 30m
Self study : 11h 15m

Description:
Introduction (basic definitions, domains ...). Derivative of a function. Cases of two components (examples, parametric and rectangular equations of curves). Cases of two and three components (dot product, module, cross product). Derivative of a product. Tangent vectors. Kinematics of the point in the plane (position, trajectory, velocity, acceleration). Kinematics of the point in space (position, trajectory, velocity, acceleration).

VECTOR LINEAR FUNCTIONS OF A VECTOR VARIABLE

Learning time: 18h 45m

Theory classes: 5h
Practical classes: 2h 30m
Self study : 11h 15m

Description:
Introduction (basic definitions, domains ...). Properties. Operations. Matrices. Remarkable vectors. Systems of linear equations. Classification of systems. Discussion of systems.

VECTOR NONLINEAR FUNCTIONS OF A VECTOR VARIABLE

Learning time: 18h 45m

Theory classes: 7h 30m
Self study : 11h 15m

Description:
Introduction (basic definitions, domains ...). Study based on components. Limits. Continuity. Derivation. Invertibility.

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AN INTRODUCTION TO EXTREME VALUE ANALYSIS	Learning time: 18h 45m Theory classes: 5h Practical classes: 2h 30m Self study : 11h 15m

Description:
Absolute maximum and minimum. Local maxima and minima. Strict and not strict extremum. Stationary points. Critical points. The Weiertrass theorem.

EXTREMA OF FUNCTIONS OF ONE VARIABLE	Learning time: 18h 45m Theory classes: 5h Practical classes: 2h 30m Self study : 11h 15m

Description:
Increasing intervals. Decreasing intervals. Intervals of monotony and the sign of the derivative function. Continuity of the derivative function. Origins with null derivative. Use of the second derivative. Continuity of the second derivative. Proof of the second derivative.

EXTREMES OF FUNCTIONS OF VECTOR VARIABLE	Learning time: 18h 45m Theory classes: 5h Practical classes: 2h 30m Self study : 11h 15m

Description:
Origins with null gradient. Partial derivatives of second order. Hessian determinant. Second partial derivate test for stationary points in the case of functions of two variables Extremes and saddle points. Second partial derivative test for stationary points in the general case of a vector variable function. Hessian matrix. The sign of the eigenvalues.

LINEAR PROGRAMMING	Learning time: 18h 45m Theory classes: 7h 30m Self study : 11h 15m

Description:
LP-type problems. Linear objective function. Linear constraints. Set of feasible solutions. Optimal solution. Case of functions of two variables in polygonal regions. Use of an auxiliary line. Study of the vertices.

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Qualification system

N1: A continuous assessment by teachers will be deployed mainly in the context of small groups.
N2: There will be one action of assessment inside the semester.
N3: There will be one action of assessment at the end of the semester.

Regarding the assessment of certificates character, this will lead finally to an evaluation report, which is based on the pondered consideration of the previous notes (N).

Nfinal = 0.20 N1 + 0.32 N2 + 0.48 N3

If the average of the numbers N2 of the group of students is strictly less than 5, the personal number N2 will be replaced by the personal number N3 if this last number (N3) is higher than the previous one (N2).

In case of suspending the subject, the student will have the possibility of a reevaluation in the extraordinary period of reevaluation exams. The reevaluation note will replace the previous notes N2 and N3.
Students who have already passed the exam will not be able to attend the reevaluation of the subject. Students qualified as "not presented" will also not be able to attend the reevaluation.

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Bibliography

Basic:

Estela Carbonell, M. Rosa; Saà Seoane, Joel. Cálculo con soporte interactivo en Moodle. Madrid: Pearson Educación, 2008. ISBN 9788483224809.

Pelayo Melero, Ignacio M.; Rubio Montaner, Francisco. Álgebra lineal básica para ingeniería civil. Barcelona: Edicions UPC, 2008. ISBN 9788483019610.

Fernández Pérez, Carlos; Vázquez Hernández, Francisco José; Vegas Montaner, José Manuel. Cálculo diferencial de varias variables. Madrid: Thomson, cop. 2002. ISBN 8497320565.

Haeussler, Ernest F; Paul, Richard S; Wood, Richard J. Matemáticas para administración y economía. Decimotercera edición. México: Pearson Educación, 2015. ISBN 9786073229166.

Marsden, Jerrold E; Tromba, Anthony. Cálculo vectorial [on line]. Sexta edición. Madrid: Pearson, [2018]Available on: <http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=7634>. ISBN 9788490355787.

Complementary:

Burgos Román, Juan de. Álgebra lineal y geometría cartesiana. 3ª ed. Madrid [etc.]: McGraw-Hill, 2006. ISBN 8448149009.

Gibergans Bàguena, Josep. Matemáticas para la ingeniería con Maple. Barcelona: Edicions UPC, 2008. ISBN 9788483019672.

Hillier, Frederick S; Lieberman, Gerald J. Introducción a la investigación de operaciones. 3ª ed. México D.F., [etc.]: McGraw-Hill, 1991. ISBN 9684229933.

Others resources:

Hyperlink

WIRIS: la solución global para la enseñanza de matemáticas

http://www.wiris.com/

Wolfram|Alpha: Computational Knowledge Engine

http://www.wolframalpha.com/

Audiovisual material

Khan Academy/maths: Lliçons, cursos i pràctica de matemàtiques

https://www.khanacademy.org/math