PERSONA CIÈNCIA EMPRESA
Universitat Ramon Llull

COURSE: MATHEMATICS I

SUBJECT: Mathematics
MODULE: Basic Training
PROGRAM TITLE: Degree in Industrial Engineering Technology

GENERAL CHARACTERISTICS*

Type: ☑ Basic training, ☐ Compulsory elective, ☐ Optional
☐ Final degree project, ☐ Practicum

Duration: Anual **Semester/s**: 1 y 2
Number of ECTS credits: 12
Language/s: Spanish, Catalan

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION

Mathematics is an essential tool in experimental science and engineering. This course aims to deepen into the mathematical knowledge acquired in the secondary education, and develop the ability to apply that knowledge in the area of engineering.

The general contents of the subject includes: Linear algebra, linear system of equations, vector space, linear transformations, matrix diagonalization. Real functions: Limit, continuity, derivation, integration. Multivariable calculus: partial differentiation, gradient, directional derivative. Analytical geometry. Multiple Integral. Vector analysis: line and surface integral. Introduction to differential equations.

COMPETENCES

- Ability to understand and apply the necessary basic scientific knowledge (mathematics, physics and chemistry) to the practice of engineering. (E1, MECES-1)
- Ability to solve math problems that may arise in engineering. Ability to apply knowledge of: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial derivatives, numerical methods, numerical algorithms, statistics and optimization. (FB1, MECES-2)

PREREQUISITES

Competences of the earlier educational stages.

CONTENTS

0. Complex number.
Imaginary and complex numbers. Basic operations. Exponential and logarithmic functions.

1. Linear algebra.
Matrices. Basic operations. Symmetry and y trace. Function matrix. Determinant. Invers matrix. Gaussian elimination. Lineal systems of equations. Cramer's rule. Least squares fitting.

2. Vector space and linear transformations.
Vector space. Basis and dimension. Change of basis. Linear transformations. Matrix representation of a LT.

3. Inner product space and secular equations.
Inner product. Metric. Norm, distance and angles. Ortonormalization. Matrix diagonalization

4. Real functions
Definition. Limit. Continuity. Continuous functions and their properties

5. Derivation.
Definition. Properties of differential functions. High-order derivatives. Extremum. Taylor and Mc Laurin series. Indeterminate. L'Hôpital's rule.

6. Integration.
First Fundamental Theorem of Calculus. Change of variables. Integration by Parts. Rational integrals. Parity.

7. Analytical geometry.
Lines and planes in space. Distances. Conics. Quadric.

8. Multivariable calculus.
Limit. Continuity. Partial derivative. Differentiation. Gradient and directional derivatibe. Extremum.

9. Iterated integral.
Multiple Integral. Change of variables. Line and surface integrals.

10. Differential equations.
Differential equations and initial value problems. Solutions. Separation of Variables. Equations with partial derivatives: classification and solutions.

METHODOLOGY

TRAINING ACTIVITIES

Training activities	ECTS Credits	Competences
Lectures (A1)	2.6	E1, FB1
Sessions for resolution of exercises, problems and cases (A2)	1.9	E1, FB1
Seminars (A3)		
Personal mandatory activities professor-student (A4)	0.1	E1, FB1
Practical work / laboratory (A5)		
Oral and writing presentations (A6)		
Personal study activities by students (A7)	6.8	E1, FB1
Evaluation activities (exams, tests, ...) (A8)	0.4	E1, FB1
Assessment activities (A9)	0.2	FB1
TOTAL	**12.0**	

EXPLANATION OF THE TEACHING METHODOLOGY

The expository sessions of the course (which account for the 75% approx. of sessions) combine the exposure of theoretical content with solving examples and exercises, directly related with the theory explained. The practical sessions (25% approx.) are devoted exclusively to solve cases and problems. Additionally, some exercises are proposed as personal study and they are later corrected by the teacher.

The course will also have seminar sessions devoted to the resolution of questions raised by students, collecting synthetically the material studied so far. For personal study, students have available a collection of problems and exercises and textbooks.

EVALUATION

EVALUATION METHODS

Evaluation Methods	Weight	Competences
Final Exam (A)	40%	E1, FB1
Partial Exams / Tests (B)	30%	E1, FB1
Learning follow-up activities in the classroom (C)	20%	E1, FB1
Assessment activities (D)	10%	E1, FB1
Learning follow-up activities (E)	--	--

Tasks and presentations (F)	--	--
Projects (G)	--	--
Laboratory report (H)	--	--
Field or experimental work (I)	--	--
Evaluation by a Company or institution (*Practicum*) (J)	--	--
Participation (K)	--	--

LEARNING OUTCOMES

- Students must demonstrate that they know and understand the main concepts and properties of calculus, differential calculus and linear algebra (→ E1, MECES-1) [A,B,C,D]
- Students must demonstrate knowledge and skill in applying basic operations and procedures of infinitesimal and differential calculus, and of linear algebra. (→ E1, MECES-1) [A,B,C,D]
- Students must demonstrate proficiency in calculus and linear algebra for selecting and applying the most suitable mathematical methods in solving engineering problems. (→ FB1, MECES-2) [A,B,C,D]

QUALIFICATION

The evaluation of the course consider the scores of the follow-up activities, whose averages represent a continuous assessment mark (EC), two partial exams, whose average represents a second note (EP) and the final exam (EF), obtaining a mark out of 10. The final grade (FG) is calculating by the formula:

$$FG = 0.3*EC + 0.3*EP + 0.4*EF.$$

The final exam has two different parts, covering the subjects of each partial exam. The final score is calculated as the average of the two parts, only if the score are greater than 3.5 out 10 in both parts. On the contrary, the final score will be the lowest score of both parts.
When the score obtained at the final exam corresponding to a midterm exam improve the mark obtained earlier, this mark will replace it..

The student that in any of the midterm exams has got a score of 4 or higher, he can choose between giving up this part of the exam (assuming for this part of the exam the mark corresponding to the midterm exam) or submit it to the effect of improving the grade

EVALUATION OF COMPETENCES

For the evaluation of FB1 competency, it is used the final exams mark as indicator. For the evaluation of competency E1.a, the indicator used is the final mark of the subject.

TEXTBOOKS

- LARSON, HOSTETLER, EDWARDS, "*Cálculo y Geometría Analítica*", McGraw-Hill, Madrid 2005 (8ª).
- ANTON, H., "Introducción al Álgebra Lineal", Limusa-Wiley, México 2007 (3ª).