Universitat de Lleida

DEGREE CURRICULUM

CALCULUS

Coordination: MAZA SABIDO, SUSANA

Academic year 2016-17

CALCULUS 2016-17

Subject's general information

Subject name	CALCULUS
Code	102101
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	<table><tr><th>Degree</th><th>Course</th><th>Typology</th><th>Modality</th></tr><tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>1</td><td>COMMON</td><td>Attendance-based</td></tr><tr><td>Bachelor's Degree in Mechanical Engineering</td><td>1</td><td>COMMON</td><td>Attendance-based</td></tr></table>
ECTS credits	9
Groups	4GG,6GM
Theoretical credits	9
Practical credits	0
Coordination	MAZA SABIDO, SUSANA
Department	MATEMATICA
Teaching load distribution between lectures and independent student work	40% Attendance 60% Autonomous work
Important information on data processing	Consult this link for more information.
Language	Català 90% Castellà 10%
Distribution of credits	Susana Maza Sabido 18 Jordi Pujolàs Boix 9 Josep Conde Colom 9
Office and hour of attention	Agreed schedule Teacher's office

CALCULUS 2016-17

Professor/a (s/es)	Adreça electrònica professor/a (s/es)	Crèdits	Horari de tutoria/lloc
CONDE COLOM, JOSEP	jconde@matematica.udl.cat	9	
LOPEZ LORENZO, IGNACIO	nlopez@matematica.udl.cat	1,5	
MONSERRAT COMPANYS, JOAQUIM	qmonserrat@mailoo.org	3	
PUJOLAS BOIX, JORDI	jpujolas@matematica.udl.cat	13,5	
MAZA SABIDO, SUSANA	smaza@matematica.udl.cat	18	

Subject's extra information

Subject that requires continuous work throughout the semester in order to achieve its goals. It requires critical thinking and capacity for abstraction. You can find collections of these materials at the Cappont Campus (Building Aulari) and the Virtual Campus: http://cv.udl.cat - Collection set of exercises with the numerical solutions. - Resolutions of exams in previous years. It is recommended to frequently visit the site at the Virtual Campus since all the information is announced there.

Learning objectives

1.To be able to solve logical problems that can arise in engineering; to analyze the problem considered and apply the differential and integral calculus to solve it.

2. To approach a function by a Taylor development.

3.To solve optimization problems with one and several variables.

4. To calculate flat areas, lengths of plane curves, volumes, surfaces of solids of revolution, center of mass of plains regions and moments of inertia by applying integral calculus.

5. To Solve differential equations of separable variables, homogeneous and linear of first order.

6. To model physical systems using a differential equation.

7. To understand the concept of direccional derivability and the function gradient; To know their properties and use them to solve mathematical and engineering problems.

Competences

Degree-specific competences

- Ability to resolve logical problems that can arise in engineering. Aptitude to apply knowledge about lineal algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives; numeric methods, numeric algorithms; statistics and optimization.

  Goals

  - To compute fluently and apply the derivative of a function of one or several variables.
  - To solve optimization problems.
  - To approach a function by a Taylor development.
  - To manipulate, fluently calculate and apply integrals of functions.
  - To calculate flat areas, lengths of plane curves, volumes, surfaces of solids of revolution, center of mass of plains regions and moments of inertia.
  - To Solve differential equations of separable variables, homogeneous and linear of first order.
  - Modeling physical systems using a differential equation.

Degree-transversal competences

- Ability for abstraction and critical, logical and logical reasoning.

  Goals

  - To analyze the problem considered and apply the differential and integral calculus to solve it.
  - To interpret real life situations using mathematical knowledge and search for various procedures for the resolution of the problem, tending to process optimization.
  - To synthesize the statement of a problem to express it mathematically.

- Ability to resolve problems and elaborate and defend arguments inside their field of study

  Goals

  - To apply with fluency the differential and integral calculus to solve engineering problems.
  - To be able to argue and analyze the results obtained from the calculation.
  - Properly use the vocabulary of terms and mathematical notation, as well as logical reasoning, to communicate to others the results and conclusions in relation to problems.

- Ability to analyse and synthesize.

  Goals

  - To interpret real life situations using mathematical knowledge and search for various procedures for the resolution of the problem, tending to process optimization.
  - To synthesize the statement of a problem to express it mathematically.
  - To be able to argue and analyze the results obtained from the calculation.
  - To analyze the problem considered and apply the differential and integral calculus to solve it.

Subject contents

1.**Real functions of real variable.**

1.1.Elementary functions. Definition and properties.

1.2.Límits.

1.3.Continuity: definition and properties

1.4. Basic Theorems of continuous functions on intervals. Theorem of Bolzano.

2. **Derivability**

2.1.Definition and meaning of the derivative. Derived side.

2.2.Differentiable functions at intervals: Rolle's theorem, Cauchy and the average.

2.3. Hôpital rule. Calculation of limits.

2.4. Taylor development and applications.

2.5.Optimization of functions.

3. **The Riemann integral.**

3.1.Definition and properties. Geometric interpretation.

3.2.Theorem of the average value.

3.3.Theorem of fundamental calculation. Barrow's rule.

4. **Integral computations.**

4.1.Immediate integrals.

4.2.Integrals by change of variable and parts.

4.3.Integrals of rational functions.

4.4.Integrals of trigonometric functions.

5.**Aplicacions of integral calculus.**

5.1.Computation of lengths of flat arcs.

5.2.Computation of flat areas.

5.3.Volumes computation. Volumes and surfaces of revolution.

5.4.Computation of centers of mass.

5.5.Computation of moments of inertia.

6 **Functions of several variables.**

6.1.Continuity. Calculation of limits.

6.2 Derivability and differentiability.

6.3 Directional derivative and partial derivative. Tangent plane.

6.4 Taylor development.

6.5 Optimization of functions of several variables and conditional extreme.

7. **Double integration.**

7.1 Concept and properties.

7.2.Calculation of double integrals by vertical and horizontal stripes.

7.3.Change of variables in a double integral. Change to polar coordinates.

7.4.Aplicacions.

8 **Ordinary Differential Equations.**

8.1.Equacions first order ordinary differential. Particular and general solution.

8.2.Existence and uniqueness of the solution of the Cauchy problem.

8.3.Equacions of separate variables.

8.4.Homogeneous differential equacions.

8.5. Integrating factor.

8.6.Equacions linear first order. Variation of constants.

8.7. Equations of second order linear and constants coeficients.

Methodology

Classroom activities aimed distribute in two lectures and problem classes. In the lectures introduce the concepts and theoretical results even more relevant illustrating them with examples and exercises clarifiers. The classes of problems are exercises to strengthen graduate level concepts and notions desenvoluptas in lectures. It poses modeling to compare the potential of mathematical tools in engineering.

In addition, students have the responsibility to strengthen their knowledge independently on the basis of the material provided or recommended by the teacher.

Both the theoretical and the problems taught in groups doubled. The fact of having smaller groups of students promotes dialogue and student participation.

Development plan

WEEK	METHODOLOGY	CONTENTS	PRESENTIAL	AUTONOMOUS WORK
1	Lecture class	Real Functions of real variable	3	4.5
1	Problem class	Real Functions of real variable	3	4.5
2-4	Lecture class	Derivability	9	13.5

2-4	Problem class	Derivability	9	13.5
5	Lecture class	The Riemann integral	2	3
5	Lecture class	Integral computations	2	3
5	Problem class	Integral computations	2	3
6-7	Lecture class	Integral computations	6	9
6-7	Problem class	Integral computations	6	9
8-9	Lecture class	Applications of integral calculus	6	9
8-9	Problem class	Applications of integral calculus	6	9
10-12	Lecture class	Functions of several variables	9	13.5
10-12	Problem class	Functions of several variables	9	13.5
13	Lecture class	Double Integration	2	3
13	Problem class	Double Integration	4	6
14-15	Lecture class	Ordinary differential equations	6	9
14-15	Problem class	Ordinary differential equations	6	9

Evaluation

Timing and load percentage assessment activities:

Week 6. Written test. Delivery of an exercise proposed by the teacher and solved at classroom by the student. This activity contributes 10% of the total mark for the course (the highest mark you can get this test is 1 point).

Week 9. Written test. Exam of the content developed in the first weeks until the ninth. This activity contributes 40% of the total mark for the course (the highest mark you can get in this test are 4 points).

Week 13. Written test. Delivery of an exercise proposed by the teacher and solved at classroom by the student. This activity contributes 10% of the total mark for the course (the highest mark you can get this test is 1 point).

Week 16. Written test. Exam of the content developed in the weeks of 10 to 15. This activity contributes 40% of the total mark for the course (the highest mark you can get in this test are 4 points) .

The final mark will be configured with the arithmetic sum of the marks obtained in the aforementioned activities. The course will be overcome if the mark is a value equal to or greater than five.

Bibliography

The book Problemas Resueltos de Cálculo. Eines 69, Edicions de la Universitat de Lleida, 2011 (I.A. GARCÍA, J. GINÉ i S. MAZA) will be used usually in the excercises classes.

Llibre "Curso de introducción al cálculo para grados en ingeniería," Eines 73, Edicions Universitat de Lleida, 2013 (I.A. GARCÍA S. MAZA) is part of the basic literature of the course and will be used routinely in lectures.