Universitat de Lleida

DEGREE CURRICULUM

CALCULUS

Coordination: MAZA SABIDO, SUSANA

Academic year 2021-22

CALCULUS 2021-22

Subject's general information

Subject name	CALCULUS
Code	102101
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Automation and Industrial Electronic Engineering	1	COMMON	Attendance-based
Bachelor's Degree in Energy and Sustainability Engineering	1	COMMON	Attendance-based
Bachelor's Degree in Mechanical Engineering	1	COMMON	Attendance-based
Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering	1	COMMON	Attendance-based
Not informed	1	COMMON	Attendance-based

Course number of credits (ECTS)	9
Type of activity, credits, and groups	

Activity type	PRAULA	TEORIA
Number of credits	4.5	4.5
Number of groups	5	2

Coordination	MAZA SABIDO, SUSANA
Department	MATHEMATICS
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 13´5 + 4´5 (supplementary lecturing) Jordi Pujolàs Boix 4´5 Josep Conde Colom 13'5+1'5 (supplementary lecturing)

CALCULUS 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CONDE COLOM, JOSEP	josep.conde@udl.cat	10	
GARCIA RODRIGUEZ, ISAAC ANTONIO	isaac.garcia@udl.cat	2	
MAZA SABIDO, SUSANA	susanna.maza@udl.cat	10,5	
PUJOLAS BOIX, JORDI	jordi.pujolas@udl.cat	9	

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:

-Exercise collections with numerical solution.

- Exams of previous years.

It is recommended to frequently visit the site at the Virtual Campus since all the information is announced there.

This subject is scheduled in the fall semester of the 1st year. There will be supplementary lecturing (4.5 ECTS) in the 2nd semester.

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

- CB2 That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of his/her field of study.
- GEM1 / GEEIA1 / CG1, 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.
- CT5 To acquire essential notions of scientific thinking
- EPS5. Ability for abstraction and critical, logical and logical reasoning.
- EPS1. Ability to resolve problems and elaborate and defend arguments inside their field of study
- EPS6. Ability to analyse and synthesize.

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

Classes are divided into face-to-face classes and virtual classes.

Directed face-to-face classes are theory classes. The most relevant theoretical concepts and results are introduced in the theory classes, illustrating them with examples and clarifying exercises. Face-to-face classes will be taught in split groups. Having fewer groups of students promotes student dialogue and participation.

Problem classes are virtual. In the problem classes, graduate level exercises will be solved to consolidate the concepts and notions developed in the theory classes. Modeling problems will be posed to contrast the potential of mathematical tools in engineering.

In addition, students will have the responsibility to reinforce their knowledge autonomously based on the teaching material provided or recommended by the teacher.

Development plan

WEEK	METHODOLOGY	CONTENTS	PRESENTIAL OR VIRTUAL	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	3	4'5
5	Problem class	Integral computations	3	4'5
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	3	4'5
13	Problem class	Double Integration	3	4'5

14-15	Lecture class	Ordinary differential equations	6	9
14-15	Problem class	Ordinary differential equations	6	9

Evaluation

All the evaluation activities are presential.

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.

At the end of the course, the tests corresponding to the weeks 9 and 16 can be retrieved (the two or one of them can be recovered, at the student's choice). The mark obtained in each one of the recoveries will replace the note obtained during the course in this test. The final note will be the arithmetical sum of all the partial notes.

Bibliography

The book Problemas Resueltos de Cálculo. Eines 69, Edicions de la Universitat de Lleida, 2011 (Isaac .A. GARCÍA, Jaume. GINÉ & Susanna. 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 (Isaac .A. GARCÍA & Susanna. MAZA) is part of the basic literature of the course and will be used routinely in lectures.