Universitat de Lleida

DEGREE CURRICULUM

CALCULUS

Coordination: LÓPEZ MASIP, SUSANA CLARA

Academic year 2019-20

CALCULUS 2019-20

Subject's general information

Subject name	CALCULUS
Code	102321
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's degree in Industrial Organization and Logistics 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	2	2

Coordination	LÓPEZ MASIP, SUSANA CLARA
Department	MATHEMATICS
Teaching load distribution between lectures and independent student work	40% face-to-face lectures 60% self-study
Important information on data processing	Consult this link for more information.
Language	Catalan

CALCULUS 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LÓPEZ MASIP, SUSANA CLARA	susanaclara.lopez@udl.cat	18	

Subject's extra information

Calculus requires continuous work throughout the semester in order to achieve its objectives. Critical thinking and abstraction ability are required.
You can find collections of the following didactic materials on the Virtual Campus http://cv.udl.cat:
- Collection of exercises with numerical solutions.
- Resolutions of exams corresponding to previous courses.
It is recommended to frequently visit the Virtual Campus as all the corresponding information will be announced there.
Calculus is studied in the first semester of the 1st year, it belongs to the module "Basic training".

Learning objectives

1. Solve mathematical problems that may arise in engineering; analyze the problem posed and apply differential and integral calculus to solve it.
2. Approach a function for its Taylor development.
3. Solve problems of optimization of one and several variables.
4. Calculate flat areas, lengths of flat curves, volumes, surfaces of solids of revolution, centers of masses of flat regions and moments of inertia from the integral calculation.
5. Solve differential equations of separable, homogeneous and linear variables of the first order.
6. Modeling physical systems through a differential equation.
7. Understand the concept of directional derivative and gradient of a function of several variables; Knowing their properties and using them to solve mathematical problems and engineering.

Competences

Specific skills of the degree
Ability to solve mathematical problems that may arise in engineering. Aptitude to apply knowledge about: linear algebra; geometry; Differential geometry, differential, and integral calculus; Differential equations and partial derivatives; numerical methods, algorithmic, Numerical, statistical and optimization.
Goals:
- Calculate and apply fluidly the derivative of a function.
- Solve optimization problems.
- Approach a function for its Taylor development.
- Calculate integrals of one and several variables.
- Calculate flat areas, lengths of flat curves, volumes, solids of revolution surfaces, centers of masses of flat regions and moments of inertia.
- Solve differential equations of first order, separable, exact and linear variables.
- Modeling physical systems through a differential equation.

Cross-disciplinary skills of the degree
Capacity for analysis and synthesis.
Goals:

- To interpret real situations using mathematical knowledge and look for different procedures to solve the problem posed, tending to the optimization of the processes.
- Synthesize the statement of a problem in order to express it mathematically.
- Analyze and reason the results obtained from a calculation.
- Analyze the problem posed and apply fluidly the differential and integral calculation to solve it.
- Ability to solve problems and elaborate and defend arguments within their area of study.
- Apply the differential and integral calculation fluidly to solve engineering problems.
- Interpret and reason the results obtained from a calculation.
- Use the specific vocabulary of mathematical terms and notations properly, as well as logical reasoning, to communicate to others the results and conclusions obtained in the relation of problems.

Capacity for abstraction and critical, logical and mathematical reasoning.

Subject contents

1.Real functions of real variable.

1. Elementary functions. Definition and properties.
2. Límits.
3. Continuity: definition and properties
4. Basic Theorems of continuous functions on intervals. Theorem of Bolzano.

2. Derivability

1. Definition and meaning of the derivative. Derived side.
2. Differentiable functions at intervals: Rolle's theorem, Cauchy and the average.
3. Hôpital rule. Calculation of limits.
4. Taylor development and applications.
5. Optimization of functions.

3. The Riemann integral.

1. Definition and properties. Geometric interpretation.
2. Theorem of the average value.
3. Theorem of fundamental calculation. Barrow's rule.

4. Integral computations.

1. Immediate integrals.
2. Integrals by change of variable and parts.
3. Integrals of rational functions.
4. Integrals of trigonometric functions.

5.Aplicacions of integral calculus.

1. Computation of lengths of flat arcs.
2. Computation of flat areas.
3. Volumes computation. Volumes and surfaces of revolution.
4. Computation of centers of mass.
5. Computation of moments of inertia.

6 Functions of several variables.

1. Continuity. Calculation of limits.
2. Derivability and differentiability.
3. Directional derivative and partial derivative. Tangent plane.
4. Taylor development.
5. Optimization of functions of several variables and conditional extreme.

7. Multiple integration.

1. Concept and properties.
2. Calculation of double integrals by vertical and horizontal stripes.
3. Change of variables in a double integral. Change to polar coordinates.
4. Calculation of triple integrals.
5. Change of variables in a triple integral. Change in cylindrical and spherical coordinates.
6. Aplicacions.

8 Ordinary Differential Equations.

1. First order ordinary differential equations. Particular and general solution.
2. Qualitative study for the first order ODE:. Existence and uniqueness of the Cauchy problem solution. Applications of the uniqueness theorem. Balance solutions Slope fields. Phase diagrams Sketch of solutions. Classification of equilibrium solutions. Asymptotic behavior of the solutions.
3. Direct resolution methods of EDOS: Equations of separate variables. Homogeneous equations. Linear equations of first order. Variation of the constants

Methodology

The directed face-to-face activities are divided into two, theory classes and problem classes. Theoretical classes introduce the most relevant concepts and theoretical results illustrating them with examples and clarifying exercises. In the classes of problems, exercises of different levels will be solved to consolidate the concepts and notions developed in theory classes. Modeling problems will be considered to contrast the potential of mathematical tools in engineering.
In addition, students will have the responsibility to reinforce their knowledge independently based on the didactic material provided or recommended by the teaching staff.

Development plan

Week	Methodology	Syllabus	Classroom hours	Self-study
1-8	Lectures	1,2,3,4,5	16	20
1-8	Sessions of resolutions of problems	1,2,3,4,5	16	20
1-8	Working group sessions	1,2,3,4,5	3	8
9	Evaluation. Writing test 1	1,2,3,4,5	2	5
10-15	Lectures	6,7,8	10	12
10-15	Sessions of resolution of problems	6,7,8	10	12
10-15	Working group sessions	6,7,8	3	8
16	Evaluation. Writing test 2	6,7,8	2	5

Evaluation

- Control Exam1: 10%

- Partial Exam 1: 40%.

- Control Exam 2: 10%.

- Partial Exam 2: 40%.

To pass this subject, there is no minimum mark for the control exams, the partial exams have 2.5 as a minimum mark (over 10).

Partial Exams 1 and 2 (80%) can be recovered in the reevaluation exam.

It is mandatory to carry out the four evaluation tests (it is necessary to attend and develop them).

All evaluation tests can be done exclusively with a non-programmable calculator.

All evaluation tests can be done with the formulary.

The subject has two ways of evaluation:

1. **Continuous evaluation:** The evaluation of the subject takes into account the qualification of the different tests and of the exercises carried out throughout the semester. The qualification grade (NC) is obtained from the qualification NP1, NP2, NE and NCP where:

    - NP1 is the qualification of test 1, related to the contents of items 1, 2, 3, 4 and 5.
    - NP2 is the qualification of test 2, related to the contents of topics 6,7 and 8.
    - NE is the exercise resolution qualification.
    - NCP is the qualification of practical cases developed in the classroom

    NC = NP1 * 0.35 + NP2 * 0.35 + NE * 0.2 + NCP * 0.1

    Important issues:

- If any of the activities is not carried out, it will be considered qualified with a zero.
- If the 5.0 is not reached in the NC mark, it will be compulsory to take the final exam of the subject.

2. **Evaluation with final exam:** The final grade mark (NF) is obtained from the NEF and NCP qualification where:

    - NEF: qualification of the final exam.
    - NCP: qualification of the case studies.

    NF = 0.85 * NEF + 0.15 * NCP.

Important issues:

- Those who do not attend the final exam will be considered qualified with a zero.
- To pass the subject in either of the two modalities, you must obtain at least 5.0 as a CN or NF grade in each case.

Bibliography

Basic bibligraphy:

- I.A. GARCÍA i S. MAZA: Curso de introducciónal cálculo para grados en ingeniería, Eines 73, Edicions de la Universitat de Lleida, 2013.

- I.A. GARCÍA, J. GINÉ i S. MAZA: Problemas Resueltos de Cálculo, Eines 69, Edicions de la Universitat de Lleida, 2013.

Advanced bibliography:

- R. LARSON: Cálculo. Madrid: McGraw-Hill, 2006

- R.G. BARTLE i D.S.SHERBERT: Introducciónal Análisis Matemático de una variable, Ed. Limusa, México, 1984

- J.E. MARSDEN i A.J. TROMBA: Cálculo vectorial. Ed. Addison-Wesley Iberoamerica, Ed. Tercera, 1991