Universitat de Lleida

DEGREE CURRICULUM

CALCULUS

Coordination: ORTIZ CARABALLO, CARMEN MARÍA

Academic year 2018-19

CALCULUS 2018-19

Subject's general information

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

Degree	Course	Character	Modality
Not informed	1	COMMON	Attendance-based
Bachelor's degree in Industrial Organisation and Logistics Engineering	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	3	2

Coordination	ORTIZ CARABALLO, CARMEN MARÍA
Department	COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING
Important information on data processing	Consult this link for more information.

CALCULUS 2018-19

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ALBAREDA MUSSONS, ANTONI	antoni.albareda@udl.cat	11,25	
DALFÓ SIMÓ, CRISTINA	cristina.dalfo@matematica.udl.cat	2,25	
ORTIZ CARABALLO, CARMEN MARÍA	carmen.ortiz@udl.cat	9	

Subject's extra information

- This course requires continuous work throughout the semester in order to achieve the objectives set. It requires critical thinking and capacity for abstraction.
- It is recommended to visit the Virtual Campus space associated with the course frequently, since all the corresponding information is announced there and the material with which the subject will be developed will be published before the beginning of each topic.
- The calculator can not be used in any evaluation test.
- Subject that is taught in the 1st semester of the 1st year of teaching, belongs to the module "Basic training" and in the 2nd semester, 4.5 ECTS of repeated teaching are offered.

Learning objectives

1. Solve mathematical problems that may arise in engineering; analyze the problem and apply fluently the differential and integral calculus to solve it.
2. Approach a function using Taylor development.
3. Solve optimization problems of one and several variables.
4. Understand the concept of directional derivative and gradient of a function of several variables; know their properties and use it to solve mathematical and engineering problems.
5. Calculate flat areas, lengths of flat curves, volumes, surfaces of solids of revolution, centers of mass of flat regions and moments of inertia from the integral calculation.
6. Resolve differential equations of separable, homogeneous and linear variables of the first order.
7. Qualitatively analyze any differential equation of the first order.
8. Model physical systems by means of a differential equation.

Competences

Basic competences

B01 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.

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

Transversal competences

CT5. To apply essential notions of scientific thinking.

General competences

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To sSolve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Chemical Engineering/Industrial Organization Engineering.

CG10. To work in a multilingual and multidisciplinary environment.

CG11. To understand and apply the necessary legislation in the exercise of the profession of Chemical Engineering/Industrial Organization Engineering

Specific competences

CE1. To develop the ability to solve mathematical problems arisen in the engineering field. Aptitude to apply knowledge on: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and in partial derivatives; numerical methods; algorithmic, numerical; statistics and optimitation.

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 activities are divided into two types that complement each other: lecture sessions and problem solving sessions.

- **Lecture sessions:** In the lectures introduce concepts and relevant theoretical results and illustrate them with examples and exercises. It will used blackboard and computer resources, which will be previously available in the space corresponding to the subject in the Virtual Campus.
- **Problem solving:** These sessions are devoted to difficult exercises in order to gradually consolidate the concepts and ideas developed in the lectures sessions.The students will work these exercises individually or as a team. For group activities, strategies to encourage cooperative work will be used. In certain problems some computer tools (MatLab) to solve them can be used.

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

Development plan

Activities:

1. **Lectures:** The issues described in the section Contents will be held in the master classes throughout the different weeks of class. From the begining of the semester until the end of the semester. **Classroom hours** 41h **Personal learning hours** 51h
2. **Resolution of problems:** The issues described in section contents is developed in practices in the classroom during the teaching weeks. From the begining of the semester until the end of the semester. **Classroom hours** 39h **Personal learning hours** 46h
3. **Sessions in working groups:** Activities carried out in the classroom in groups supervised by the teacher in which the Case Studies will be developed. From the begining of the semester until the end of the

semester. **Classroom hours** 6h **Personal learning hours** 18h

4. **Tutorial:** Exam reviews and consulting hours will be used to answer questions and clarify concepts. In addition, tutorials will be held in working groups to review the evolution of the Case Studies. From the begining of the semester until the end of the semester.
5. **Evaluation:** The evaluation, described in the section Evaluation, will be developed by written in-person tests (exams), the delivery of exercises in the Virtual Campus and group works. From the begining of the semester until the end of the semester. **Classroom hours** 4h **Personal learning hours** 20h

Working plan:

Week	Methodology	Syllabus	Classroom hours	Personal learni
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. Writting 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. Writting test 2	6,7,8	2	5

Evaluation

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

"Curso de introducción al cálculo para grados en ingeniería", Eines 73, Edicions de la Universitat de Lleida, 2013 (I.A. GARCÍA i S. MAZA)

Problemas Resueltos de Cálculo. Eines 69, Edicions de la Universitat de Lleida, 2011 (I.A. GARCÍA, J. GINÉ i S. MAZA)