



Universitat de Lleida

# DEGREE CURRICULUM **CALCULUS**

Academic year 2013-14

## Subject's general information

<b>Subject name</b>	Calculus
<b>Code</b>	102101
<b>Semester</b>	1er Q Avaluació Continuada
<b>Typology</b>	Troncal
<b>ECTS credits</b>	9
<b>Theoretical credits</b>	0
<b>Practical credits</b>	0
<b>Department</b>	Matemàtica
<b>Teaching load distribution between lectures and independent student work</b>	40% presencials 60% treball autònom
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.
<b>Language</b>	Català 90% Castellà 10%
<b>Distribution of credits</b>	Susana Maza Sabido 18 Jordi Pujolàs Boix 9 Josep Conde Colom 9
<b>Office and hour of attention</b>	Horari a consensuar amb l'alumne Lloc; Despatxs del professorat de l'assignatura

Susana Maza Sabido  
Jordi Pujolàs Boix  
Josep Conde Colom

## 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 Aularí) 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

See competences

## 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.

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## 5. Aplicaciones 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

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Les activitats presencials dirigides es distribueixen en dos, classes de teoria i classes de problemes. A les classes de teoria s'introdueixen els conceptes i resultats teòrics més rellevants tot il·lustrant-los amb exemples i exercicis clarificadors. A les classes de problemes es resoldran exercicis de nivell graduat per consolidar els conceptes i nocions desenvolupats en les classes de teoria. Es plantejaràn problemes de modelació per contrastar el potencial de les eines matemàtiques en l'enginyeria.

A més a més, els estudiants tindran la responsabilitat de reforçar els seus coneixements de manera autònoma prenent com a base el material didàctic facilitat o recomanat pel professor.

Tant les classes teòriques com les de problemes s'impartiràn en grups desdoblats. El fet de tenir grups menys nombrosos d'estudiants afavoreix el diàleg i la participació de l'alumne.

## Development plan

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Temporalització dels continguts de l'assignatura:

- Setmanes 1 i 2 (Tema 1. **Funcions reals de variable real**)
- Setmanes 3,4 i 5 (Tema 2. **Derivabilitat**)
- Setmana 6 (Tema 3. **La integral de Riemann**)
- Setmana 6,7 i 8 (Tema 4. **Càlcul de primitives** )
- Setmana 8 i 10 (Tema 5. **Aplicacions del càlcul integral** )
- Setmana 11 i 12 (Tema 6. **Funcions de vàries variables** )
- Setmana 13 (Tema 7. **Integració doble** )
- Setmana 14 i 15 (Tema 8. **Equacions diferencials ordinàries** )

## Evaluation

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Temporalització i càrrega percentual de les activitats d'avaluació:

- **Setmana 6.** Entrega d'un exercici proposat pel professor i resolt a classe per l'alumne. Aquesta activitat contribueix amb el 10% de la nota total de l'assignatura (la màxima nota que es pot obtenir en aquesta prova es 1 punt).
- **Setmana 9.** Examen pràctic dels continguts desenvolupats a classe en les setmanes de la 1 fins la 9 . Aquesta activitat contribueix amb el 40% de la nota total de l'assignatura (la màxima nota que es pot obtenir en aquesta prova són 4 punts).
- **Setmana 13.** Entrega d'un exercici proposat pel professor i resolt a classe per l'alumne. Aquesta activitat contribueix amb el 10% de la nota total de l'assignatura (la màxima nota que es pot obtenir en aquesta prova es 1 punt).
- **Setmana 16.** Examen pràctic dels continguts desenvolupats a classe en les setmanes de la 10 fins la 15. Aquesta activitat contribueix amb el 40% de la nota total de l'assignatura (la màxima nota que es pot obtenir en aquesta prova són 4 punts).

La nota final es configurarà amb la suma aritmètica de les notes obtingudes en les activitats abans esmentades. L'assignatura quedrà superada si la nota és un valor igual o superior al 5.

## 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.

Here we propose a list of the complementary literature.

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### Llibres bàsics:

F.COQUILLAT. Cálculo Integral. Ed. Tébar Flores, Madrid, 1997.

F.GRANERO. Cálculo Infinitesimal. Ed. McGraw-Hill, Madrid, 1996.

N.PISKUNOV. Cálculo diferencial e Integral. Ed. Montaner y Simón, S.A.,Barcelona, 1970.

S. L.SALAS i E. HILLE. Calculus. Ed. Reverté, S. A., Barcelona, 1994.

### Exercicis i problemes:

F.AYRES, Cálculo diferencial e integral. McGraw-Hill.

B. DEMIDOVICH. Problemas y Ejercicios de AnálisisMatemático. Ed. Paraninfo, Madrid, 1982.

A.KISELIOV, M. KRASNOV i G. MAKARENKO. Problemas de ecuaciones diferenciales ordinarias.Ed. Mir, Moscú, 1973.

M.R.SPIEGEL, Cálculo superior. McGraw-Hill.

### Lectures recomanades i llibres de consulta:

S.LANG, Cálculo. Addison-Wesley Iberoamericana.

M.SPIVAK, Cálculus. Ed. Reverté

S.K.STEIN, Cálculo y geometría analítica. McGraw-Hill.