Universitat de Lleida

DEGREE CURRICULUM

CALCULUS AND STATISTICS

Academic year 2014-15

2014-15

Subject's general information

Subject name	Calculus and Statistics
Code	101400
Semester	1st S Continuous Evaluation
Typology	Troncal
ECTS credits	7.5
Theoretical credits	0
Practical credits	0
Office and hour of attention	Maite Grau Montaña: to concur. Office1.12 at "Escola Politècnica Superior" -- Nacho López: to concur.
Department	Mathematics
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Catalan
Degree	Degree in Architectural Technology
Office and hour of attention	Maite Grau Montaña: to concur. Office1.12 at "Escola Politècnica Superior" -- Nacho López: to concur.
E-mail addresses	nlopez@matematica.udl.es mtgrau@matematica.udl.cat

Maite Grau Montaña
Nacho López

Subject's extra information

Suggestions

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.

The course as part of the academic plan

This course is in the 1st semester of 1st year of teaching. It belongs to the module of "Basic Training", specifically in the field "Scientific Basis".

Learning objectives

• To manipulate, fluently calculate and apply derivatives from single and multiple variables functions.

• Determine the maximum and minimum and solve optimization problems.

• To represent garphically a real function, of one or two variables, and highlight the main features.

• Apply the bisection method to find approximations of the zeros of functions in one real variable.

• Calculate the equation of the line / plane / hyperplane tangent to a function at a given point.

• To manipulate, fluently calculate and apply integrals expressions.

• Derive and apply approximative integration formulas.

• Calculate flat areas, lengths of curves nd volumes or surfaces of solids of revolution.

• Describe the center and dispersion of a statistical distribution.

• Interpret data obtained in an experiment and draw conclusions.

• To analyze and deduce conclusions from the graphical representation of a statistical variable.

• Calculate proportions of values ??in normal models.

• Determine the statistical correlation between two variables.

• Synthesize the statement of a problem in order to express it mathematically.

• Use mathematical techniques to solve problems.

• Reason and analyze the numerical results obtained from the calculation.

• Ability to analyze and synthesise.

Competences

EPS1. Capacity to solve problems and prepare and defence arguments inside the area of studies.

EPS2. Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.

EPS5. Capacity of abstraction and of critical, logical and mathematical thinking.

EPS6. Capacity of analysis and synthesis.

GEE1. Aptitude to apply the knowledge related with numerical and infinitesimal calculus, linear algebra, analytical and differential geometry, techniques and probabilistic methods and statistical analysis.

GEE2. Applied knowledge of the principles of general mechanics, the statics of structural systems, the geometry of masses, the principles and methods of analysis of the elastic behaviour of the solid.

Subject contents

1. Elementary functions. Continuity and differentiation in one variable.

1.1.Definition of function.

1.2.Domain and range.

1.2.Graphical representation.

1.3.Exponential and logarithmic functions.

1.4.Trigonometrical functions.

1.5.Continuity at a point.

1.6.Theorem of Bolzano and bisection method.

1.7.Concept of derivative at a point. Derivative function.

1.8.Properties of the derivative function.

1.9. Table of derivatives functions and chain rule.

1.10. Derivatives of higher order (different notations).

1.11. Line tangent at a point.

1.12. Monotonicity, concavity and convexity.

1.13. Relative extremal points and inflection points.

1.14. Application of the derivative: optimization problems.

1.15. Theorem of Rolle and Theorem of the mean value.

2. Differentiation of real functions of real variables.

2.1. Generalization of the derivative for functions of several variables.

2.2. Partial derivative. Directional derivative.

2.3. Gradient of a function. Tangent plane.

2.4. Successive partial derivatives. Schwartz rule.

2.5. Relative extrema. Hessian matrix.

2.6. Jacobian matrix. Chain rule.

2.7. Optimization of functions with restrictions. Lagrange multipliers.

3. Integration in one variable.

3.1. Concept of integral and its properties.

3.2. Relation between integral and derivative: Rule of Barrow.

3.3. Primitive computation.

3.4. Improper integrals.

3.5. Simple Newton-Cotes formuli: trapezoid and Simpson.

3.6. Composite Newton-Cotes formuli: trapezoid and Simpson.

3.7. Indeterminate coefficient method.

3.8. Planar areas computation.

3.9. Applications.

3.9.1. Length of an arc of a curve.

3.9.2. Volumes and surfaces of solids of revolution.

4. Basic applied statistics.

4.1. Analysis and data representation.

4.2. Concepts of basic statistical analysis: population, variable, sample.

4.3. Absolute frequency. Relative frequency.

4.4. Distribution of a statistical variable.

4.5. Search and tabulation of data. Significant digits and rounding.

4.6. Data representation methods.

4.7. Outliers.

4.8. Central tendency: mean and median.

4.9. Dispersion: standard deviation and quartiles.

4.10. Shape of a distribution: symmetry and asymmetry.

4.11. From histogram to the density function.

4.12. Center and dispersion of a random variable.

4.13. Normal model.

4.13.1. Gaussian bell.

4.13.2. 68 - 95 - 99.7 rule

4.13.3. Tipification

4.13.4. Tabulation of the probability distribution function.

4.14. Linear regression

4.14.1. Points diagram

4.14.2. Computation of the regression lines.

4.14.3. Computation and interpretation of the linear correlation coefficient.

Methodology

See "Development Plan".

Development plan

The topics described in the Contents will be developed by lectures and exercices solved at class during all the weeks of classes.	
Hours at class: 42h	Homework: 63h

The topics described in the Contents will be developed by lectures and exercices solved at class during all the weeks of classes.
Hours at class: 28h Homework: 42h

The evaluation, described in the Evaluation part, will be developed by exams and deliver of exercices.
Hours at class: 6h Homework: 10h

The revisions of the exams and the meetings with the professor are to solve issues and clarify concepts.
Hours at class: 8h Homework: 0h

Evaluation

Exam PA1
Written exam (individual and compulsory)
Date: november and following the school calendar http://www.eps.udl.cat/info_acad/horaris_calendaris/calendari_examens.html
Percent on the final mark: 40%
Remark: To consider the mark on the delivered exercises a mark of at least 4 (over 10) in PA1 and PA2 is required.
Objectives: • Synthesize the statement of a problem in order to express it mathematically • Reason and analyze the numerical results obtained from the calculation. • To represent graphically a real function, of one or two variables, and highlight the main features. • Apply the bisection method to find approximations of the zeros of functions in one real variable. • Calculate the equation of the line / plane / hyperplane tangent to a function at a given point. • To manipulate, fluently calculate and apply derivatives from single and multiple variables functions. • Determine the maximum and minimum and solve optimization problems. • Use mathematical techniques to solve problems.
Exam PA2
Written exam (individual and compulsory)
Date: january and following the school calendar http://www.eps.udl.cat/info_acad/horaris_calendaris/calendari_examens.html
Percent on the final mark: 40%
Remark: To consider the mark on the delivered exercises a mark of at least 4 (over 10) in PA1 and PA2 is required.

Exam PA2
Objectives • To manipulate, fluently calculate and apply integrals expressions. • Derive and apply approximative integration formulas. • Calculate flat areas, lengths of curves nd volumes or surfaces of solids of revolution. • Describe the center and dispersion of a statistical distribution. • Interpret data obtained in an experiment and draw conclusions. • To analyze and deduce conclusions from the graphical representation of a statistical variable. • Calculate proportions of values ??in normal models. • Determine the statistical correlation between two variables. • Synthesize the statement of a problem in order to express it mathematically. • Use mathematical techniques to solve problems.

Deliver of exercises
Deliver of exercises
Date: in each week of classes, there is one statement to be solved and deliver. Random ask.
Percent of the final mark: 20% (two of the delivered exercises are considered, with a weight of 10% each of them on the final mark)
Remark: To consider the mark on the delivered exercises a mark of at least 4 (over 10) in PA1 and PA2 is required.
Objectives: All of the subject.

Resit exam
Written exam (individual and noncompulsory)
Date: january/february and following the school calendar http://www.eps.udl.cat/info_acad/horaris_calendaris/calendari_examens.html
Percent on the final mark: 80%
Remarks: The content of this exam covers **all the topics** of the subject. To consider the mark on on the delivered exercises a mark of at least 4 (over 10) in this exam is required. All the student can do this exam in order to improve their mark.
Objectives: All of the subject.

Bibliography

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