Universitat de Lleida

DEGREE CURRICULUM

CALCULUS AND STATISTICS

Coordination: GRAU MONTAÑA, MARIA TERESA

Academic year 2023-24

CALCULUS AND STATISTICS 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>CALCULUS AND STATISTICS</td></tr>
<tr><td>Code</td><td>101400</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Architectural Technology and Building Construction</td><td>1</td><td>COMMON/CORE</td><td>Attendance-based</td></tr>
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</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>7.5</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><th>Number of credits</th><td>3</td><td>4.5</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>GRAU MONTAÑA, MARIA TERESA</td></tr>
<tr><td>Department</td><td>MATHEMATICS</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>40% at the classroom, 60% autonomous work
See "Development plan".</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan</td></tr>
</table>

CALCULUS AND STATISTICS 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GRAU MONTAÑA, MARIA TERESA	maite.grau@udl.cat	7,5	

Subject's extra information

To follow this subject properly the previous knowledge taught in the subject Mathematics of the “Bachillerato Tecnológico” (see http://xtec.gencat.cat/ca/curriculum/batxillerat/curriculum/) is needed. In particular , the sections on analysis and probability and statistics.

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 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 graphically a real function, of one or two variables, and highlight the main features.
- 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.
- 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.

Competences

Cross-disciplinary competences of the degree:

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.

Specific competences of the degree:

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.

4.15 Confidence intervals

4.15.1 Case: known sigma

4.15.2 t-Student distribution

4.15.3 Case: sigma unknown

4.16 Hypothesis testing

4.16.1 Null and alternative hypothesis

4.16.2 P value of the test

4.16.3 alpha significance level

4.16.4 contrast statistic

4.16.5 contrast of the mean in a sample.

Methodology

Lectures: Classes to explain the theory and problem solving on the blackboard or using videos.

Resolution of problems: students solve problems individually during these sessions under the supervision of teachers of the subject.

Exam: two written tests are held during the semester. There is also a final retrieval test.

Follow-up tests: two follow-up written tests are carried out during the semester.

Development plan

Week	Methodology	Contents	Hours at classroom	Hours of autonomous work
Weeks 1 - 4	Lectures	Chapter 1	12	18
Weeks 1 - 4	Resolution of problems	Chapter 1	8	12
Weeks 5 - 8	Lectures	Chapter 2	12	18
Weeks 5 - 8	Resolution of problems	Chapter 2	7	15
Week 6	Follow-up test	Chapters 1 and 2	1	0
Week 9	1ª test of evaluation (exam)	Chapters 1 and 2	1.5	
Weeks 10 - 11	Lectures	Chapter 3	6	9
Weeks 10 - 11	Resolution of problems	Chapter 3	4	6
Weeks 12 - 15	Lectures	Chapter 4	12	18
Weeks 12 - 15	Resolution of problems	Chapter 4	7	15
Week 13	Follow-up test	Chapters 3 and 4	1	0
Weeks 16 and 17	2ª test of evaluation (exam)	Chapters 3 and 4	1.5	
Week 20	Retrieval test	All the contents of the subject	2	

Evaluation

All assessment activities are face-to-face, individual and compulsory.

Timing and percentage load of assessment activities:

PS1. Week 6. Follow-up written test. Delivery of an exercise proposed by the teacher and solved in class by the student. This activity
contributes 10% of the total mark of the subject

PA1. Week 9, following the school's academic calendar. written test Examination of the contents developed in class in the weeks from 1 to 9. This
activity contributes with 40% of the total mark of the subject.

PS2. Week 13. Follow-up written test. Delivery of an exercise proposed by the teacher and solved in class by the student. This activity
contributes 10% of the total mark of the subject.

PA2. Week 16, following the school's academic calendar. written test Examination of the contents developed in class in the weeks from 10 to 15. This
activity contributes with 40% of the total mark of the subject.

The final mark is configured with the marks of each of the four mentioned tests with their corresponding percentage. The subject will remain
passed if the grade is a value equal to or higher than 5.

Resit exam. End of year, following the school's academic calendar. Examination of all the contents of the subject (all the topics). This activity counts for 80% of the total grade of the subject. All students can take this test to recover/improve their grade.

Alternative assessment. The student who is granted the option of alternative assessment must take the two partial exams (PA1 and PA2) on the dates set in the school's exam calendar. Each of these tests will count for 50% of the final grade. This student can also take the resit exam on the date set by the school, which will count for 100% of the final grade.

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