Course guides
310005 - 310005 - Applied Statistics

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Unit in charge: Barcelona School of Building Construction
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN BUILDING CONSTRUCTION SCIENCE AND TECHNOLOGY (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2015). (Compulsory subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer: Serrat Pie, Carles

Others: Serrat Pie, Carles
Bruguera Padro, Maria Montserrat

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. FB-1 Aptitude to use the applied knowledges related with the numerical and infinitesimal calculus, linear algebra, analytic and differential geometry, and the probabilistic and statistical analysis thecniques and methods.

Transversal:
1. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
3. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

The supervised learning hours are planed in 4 different classes:

a) Theoretical classes (big group). The faculty introduce the general learning objectives and the basic concepts of the subject. These concepts are illustrated with the resolution of practical exercises that motivate the students in their learning. The support material is disclosed previously in ATENEA: teaching plan, learning objectives by topics, support slides of the concepts, examples, evaluation activities schedule and bibliography.

b) Problem classes (medium group). In groups of 3 or 4 students and by means of exercises and numerical problems, related with the specific learning objectives of the subject contents. The documentation for these classes can be found in ATENEA since the beginning of the course. On the class itself are given the guide problems which deal with all the concepts and techniques studied. Besides, in these problem classes it is expected to develop some generic competences, like teamwork competence with cooperative learning techniques in the class.

c) The activities known as Integrated Project. It is an activity divided in the same two contents (PI1 and PI2) of the course and allows that the student individually or in group overtake the knowledge and the competences achievement by means of the theoretical aspects, the problems resolution and the data statistical analysis. The faculty assitance of these activities will be in-person (in the faculty office hours) or with ATENEA.

d) Lab classes. These classes will be done in the computer room or in the usual classroom with the students' laptops. Individually or in pairs the students use Minitab software for solving data analysis exercises. The classes focus on the practical aspect of the subject and the concepts and methods related with the contents. The students can find in ATENEA the software, so that they can follow the lab sessions in their autonomous hours. The wording and the two blocks (PI1 and PI2) of the Integrated Project are given in English for contributing to the third language generic competence.

There also have to be considered other autonomous learning hours of the students like the hours dedicated to the study of the different course topics, the bibliography extension, the problems resolution, the lab practices and Integrated Project monitoring and the resolution of the self-learining tests of the different contents by ATENEA. Besides, the student must do all the self-learning evalutions of each topic in the fixed schedule for contribute to the autonomus learning-Level 1 competence.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, students should be able to:

- Know how to describe one-dimensional and two-dimensional data groups, and their variability, either in a numerical or graphical form.
- Identify the interrelation between two statistic variables from their correlation.
- Use the regression tools (linear and non-linear) in order to do a prediction.
- Understand the concepts and experiences of randomness.
- Understand the probability concepts and conditional probability.
- Calculate the probability of random events in simple experiences.
- Use the concept of random variable as a description element of the variability of a random experience and its modelling.
- Identify the probability distribution and the expectation and variance parameters of random discrete and continuous variables: Bernoulli, Binomial, Poisson, Uniform, Normal, t-Student, Khi2 Pearson, as well as to calculate the probabilities associated in the aforementioned random variables.
- Understand the need and the concept of estimator of a population parameter, as a random variable, from the obtained information of a sample.
- Distinguish the concepts of bias and estimator consistency.
- Estimate the expected value and the variance of a population from the correspondent sample statistics and for a given confidence level. In particular, to estimate proportions.
- Use hypothesis testing (two-sided and one-sided) for the decision making.
- Analyse and interpret data using an analytical statistics software (Minitab).

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours medium group	15,0	10.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

C1 Descriptive Statistics Review and Random Variables

Description:
This content work with the first three themes: Descriptive Statistics Review, Discrete Random Variables (VAD) and Continuous Random Variables (VAC). Specifically,

The Descriptive Statistic Review works:
- Population and associated statistic variables.
- Uni-dimensional distributions and its representations.
- Uni-dimensional statistics and its representations.
- The Theorem or Inequality of Txebyshev (for data).
- The axiomatic theory of probability and derived properties.
- The tool of the tree diagrams for the representation of the sample space.
- The concept of conditional probability and the Bayes formula.

The VAD theme works:
- The concept of discrete random variable (r.v.), probability function and associated distribution function.
- The definition and calculation of the hope and variance of a discrete r.v.
- The Theorem or Inequality of Txebyshev (for r. v. discrete).
- The Bernoulli, Binomial and Poisson distributions.

The VAC theme works:
- The concept of continuous random variable (r. v.), density function and associated distribution function.
-The definition of Hope and variance of a continuous r. v.
-The Theorem or Inequality of Txebyshev (for r. v. continuous).
-the Normal distribution, t-Student y Chi^2.
- The approximation of the Binomial distribution by the Normal or Poisson.

Each theme works in the resolution of problems associated to the previous concepts, manually and using the softwareMinitab.

Related activities:
This does the activities of solving guide problems corresponding to each topic of the first content, PG1, PG2 and PG3, the PI1 project activity and the evaluation activity Q1 (Atenea) and the practice in the Laboratory L1, and the written test PE1 about the content C1.

Full-or-part-time: 75h
Theory classes: 15h
Practical classes: 15h
Self study : 45h

Statistical Inference and Linear Models

Description:
In this content the last two subjects are worked, Statistical Inference, IE and Linear Models, ML. Specifically,

In the Theme of Statistical Inference, IE, we work:
- The necessity of estimating a population parameter from sample statistics, and its character as a random variable.
- The concepts of bias, consistency and efficiency of an estimator.
- The difference and interpretation of the point estimate and the interval estimation.
- The calculation of confidence intervals for the estimation of means.
- The calculation of confidence intervals for estimation of variance (or standard deviation).
- The calculation of confidence intervals for the estimation of proportions.
- The contrast of hypotheses (bilateral and unilateral) for decision making.

In the Linear Models Theme, ML, we work:
- Two-dimensional distributions and their representation.
- The marginal distributions.
- The concepts of covariance, correlation and coefficient of determination.
- The calculation and use for prediction of the regression lines of Y over X and of X over Y.

In both themes, work is done to solve problems associated with the above concepts, manually and using Minitab software.

Related activities:
The activities of resolution of problems PG4 and PG5, the project activity PI2, the evaluation activities Q2(Atenea) and L2 (Practice in the laboratory) and PE2 that corresponds to the written exam of the content C2.

Full-or-part-time: 75h
Theory classes: 15h
Practical classes: 15h
Self study : 45h

ACTIVITIES

A1 CONTENT 1 QUESTIONNAIRE (Q1)

Description:
Individual questionnaire done in Atenea (in the EPSEB computer classroom), with 8 questions and penalization. The dedication of self-knowledge is an estimation of the time the student may need for the preparation of the exam. This time includes the realization of 9 attempts (3 attempts for each lesson T1, T2 and T3) of simulation of the questionnaire, on the same background, in order to learn and self-evaluate him/her. The 9 self-evaluations will be done in the established time. Its realization is compulsory for the assistance to the official questionnaires.

Specific objectives:
The purpose of the questionnaire is to evaluate if the student is able to:
- Know how to describe sets of unidirectional data and their variability, numerically and graphically.
- Use the concepts of randomness and random experience.
- Apply the concepts of probability and conditional probability.
- Calculate the probabilities of random events in simple experiences.
- Use the concept of random variable as an element to describe the variability of a randomized experience and its modeling.
- Identify the distribution of probability and the parameters of expectation and variance of the discrete and continuous random variables: Bernoulli, Binomial, Poisson, Uniform, Normal, t-Student, Chi^2 Pearson, as well as calculate probabilities associated with the aforementioned random variables.

Material:
Preparation/study: presentation documents, exercises resolution and evaluation questionnaires. These documents can't be brought to the questionnaire.
Questionnaire: Atenea questionnaire

Delivery:
Record of the answer made by the student in Atenea. The corrected resolution is commented with the corresponding feedback of the teaching staff in a global manner in the next session and in a private way in hours of attention to the students. Represents one third of the content note 1, N1.

Full-or-part-time: 9h
Theory classes: 0h 40m
Self study: 8h 20m

A3 PUNTUABLE LABORATORY CONTENT 1 (L1)

Description:
Laboratory exam consisting of the resolution of problems about the data analysis done with Minitab software. The laboratory is done in the computer room of the EPSEB. The data set distributed for the analysis will be similar to the first part of the Integrated Project (PI1). The self-learning dedication indicated is a estimation of the time that the student can need for preparation, basically dedicated to redo the practical lab classes and the fulfillment of the activity PI1.

Specific objectives:
The purpose of the score is to validate if the student is able to make a analysis of data report that includes:
- Know how to describe sets of unidirectional data and their variability, numerically and graphically.
- Use the concepts of randomness and random experience.
- Apply the concepts of probability and conditional probability.
- Calculate the probabilities of random events in simple experiences.
- Use the concept of random variable as an element to describe the variability of a randomized experience and its modeling.
- Identify the distribution of probability and the parameters of expectation and variance of the discrete and continuous random variables: Bernoulli, Binomial, Poisson, Uniform, Normal, t-Student, Chi^2 Pearson, as well as calculate probabilities associated with the aforementioned random variables.

Material:
Preparation/study: All the course material for the content 1, specially the execution of Minitab practices. Any of this material can be used during this laboratory.
At the time of the scoring: Statement of problems to be solved by using the Minitab software.

Delivery:
Record of the answer made by the student in Atenea. The corrected resolution is commented with the corresponding feedback of the teaching staff in a global manner in the next session and in a private way in hours of attention to the students. Represents one third of the content note 1, N1.

Full-or-part-time: 9h
Theory classes: 0h 40m
Self study: 8h 20m

A2 WRITTEN EXAM OF CONTENT 1 (PE1)

Description:
Written exam consisting of the resolution of problems/questions about the contents block 1. The autonomous self-learning dedication is an estimation of the time that the student can need for the preparation, basically dedicated to the resolution of the exercises disclosed in Atenea and the revision of the guide problems (PG1, PG2 and PG3).

Specific objectives:
The purpose of the exam is to validate if the student is able to solve, through a well-written and well-reasoned answer, problems and / or development issues:
- Know how to describe sets of unidirectional data and their variability, numerically and graphically.
- Use the concepts of randomness and random experience.
- Apply the concepts of probability and conditional probability.
- Calculate the probabilities of random events in simple experiences.
- Use the concept of random variable as an element to describe the variability of a randomized experience and its modeling.
- Identify the distribution of probability and the parameters of expectation and variance of the discrete and continuous random variables: Bernoulli, Binomial, Poisson, Uniform, Normal, t-Student, Chi^2 Pearson, as well as calculate probabilities associated with the aforementioned random variables.

Material:
Preparation / Study: All the course material related to the content C1, specially the presentation files, the resolution of examples and exercises. Any of these materials can be used during the exam.
At the exam: Statement of the exam and what has been previously announced.

Delivery:
Answer sheet of the student corresponding to the written part. The corrected resolution with the corresponding feedback of the faculty is commentated on the next session and personally in the office hours. It worths one third of the content 1 score, N1.

Full-or-part-time: 10h
Theory classes: 1h 20m
Self study: 8h 40m

A4 CONTENT 2 QUESTIONNAIRE (Q2)

Description:
The exam consist of an individual questionnaire in Atenea, with 8 questions with a single answer and with penalty, which is done individually in the computer room of the EPSEB. The dedication of autonomous learning indicated is an estimate of the time that the student may need to prepare.
This time includes the realization of 6 attempts (3 attempts for each of the two IE and ML subjects) of simulation of the test in the same environment, with the purpose of self-learning and self-evaluation. The 6 self-assessments must be done within the term established by the teaching staff and its realization is a necessary condition for the assistance to the points of the second Content.

Specific objectives:
The purpose of the questionnaire is to evaluate if the student is able to:
- Understand the need and concept of the estimator of a population parameter, as a random variable, based on the information obtained from a sample.
- Differentiate the concepts of bias and consistency of an estimator.
- To estimate the expectation and the variance of a population based on the corresponding sample statistics and for a given level of confidence. In particular, estimate proportions.
- Use the hypothesis test (bilateral and unilateral) for decision making.
- Describe sets of two-dimensional data and their variability, numerically and graphically.
- Identify the interrelation between two statistical variables based on the correlation between them.
- Use the regression tools (linear and non-linear) to make predictions.

Material:
Preparation/study: All the content 2 material, specially the exposition files, the resolution of exercises and the self-learning tests. None of these materials can be used during the exam.
Questionnaire: Atenea questionnaire to be answered and sent to the intranet of the subject and the one expressly authorized.

Delivery:
Register of the answers of the student. The corrected resolution is commented by the faculty. It is one third of the content 2 score, N2.

Full-or-part-time: 9h
Theory classes: 0h 40m
Self study: 8h 20m

A5 PUNTUABLE LABORATORY CONTENT 2 (L2)

Description:
Laboratory exam consisting in the resolution of problems about the data analysis done with Minitab software. The laboratory is done in the computer room of the EPSEB. The data set distributed for the analysis will be similar to the first part of the Integrated Project (PI2). The self-learning dedication indicated is a estimation of the time that the student can need for preparation, basically dedicated to redo the practical lab classes and the fulfillment of the activity PI2.

Specific objectives:
The purpose of the laboratory exam is to evaluate if the student is able to prepare a report that includes:
- Understand the need and concept of the estimator of a population parameter, as a random variable, based on the information obtained from a sample.
- Differentiate the concepts of bias and consistency of an estimator.
- To estimate the expectation and the variance of a population based on the corresponding sample statistics and for a given level of confidence. In particular, estimate proportions.
- Use the hypothesis test (bilateral and unilateral) for decision making.
- Describe sets of two-dimensional data and their variability, numerically and graphically.
- Identify the interrelation between two statistical variables based on the correlation between them.
- Use the regression tools (linear and non-linear) to make predictions.

Material:
Preparation/study: All the course material for the content 2, specially the execution of Minitab practices. Any of this material can be used during the questionnaire.
Questionnaire: Atenea questionnaire with the use of Minitab software.

Delivery:
Record of the answer made by the student in Atenea. The corrected resolution is commented with the corresponding feedback of the teaching staff in a global manner in the next session and in a private way in hours of attention to the students. Represents one third of the content score 2, N2.

Full-or-part-time: 9h
Theory classes: 0h 40m
Self study: 8h 20m

A6 WRITTEN EXAM OF CONTENT 2 (PE2)

Description:
Written exam consisting of the resolution of problems/questions about the contents block 2. The autonomous self-learning dedication is an estimation of the time that the student can need for the preparation, basically dedicated to the resolution of the exercises disclosed in Atenea and the revision of the guide problems (PG4 and PG5).

Specific objectives:
The purpose of the exam is to validate if the student is able to solve, through a well-written and well-reasoned answer, problems and / or development issues:
- Understand the need and concept of the estimator of a population parameter, as a random variable, based on the information obtained from a sample.
- Differentiate the concepts of bias and consistency of an estimator.
- To estimate the expectation and the variance of a population based on the corresponding sample statistics and for a given level of confidence. In particular, estimate proportions.
- Use the hypothesis test (bilateral and unilateral) for decision making.
- Describe sets of two-dimensional data and their variability, numerically and graphically.
- Identify the interrelation between two statistical variables based on the correlation between them.
- Use the regression tools (linear and non-linear) to make predictions.

Material:
Preparation / Study: All the course material related to the content C1, specially the presentation files, the resolution of examples and exercises. Any of these materials can be used during the exam.
At the exam: Written statement and what it is expressly authorized.

Delivery:
Answer sheet of the student corresponding to the written part. The corrected resolution with the corresponding feedback of the faculty is commentated on the next session and personally in the office hours. It worths one third the mark of the content 2, N2.

Full-or-part-time: 10h
Theory classes: 1h 20m
Self study: 8h 40m

A7 GUIDE PROBLEM THEME 1, CONTENT 1 (PG1)

Description:
Activity done in the problems class, medium group, consisting on the resolution, individually or in group (maximum groups of 4 students), of a guide problem that collect the main practical aspects of the Content 1. The autonomous self-learning dedication is a stimation of the time that the student need afterwards the class for revising and consolidating the specific objectives of the activity.

Specific objectives:
At the end of the activity, the student should be able to:
- Describe one-dimensional data sets and its variability, in a numerical and a graphical way.
- Know about randomness and random experiments.
- Apply the ideas on probability and conditional probability.
- Compute random events probabilities in simple experiments.

Material:
Preparation / Study: The notes and presentations of the course for the Content 1, particularly the resolution of the examples which have ilustrated the introduction of concepts.
During the activity: The current material and the wording of the guide problem which the professor distribute in the same session.

Delivery:
The exercise is carried out by groups and simultaneously on the blackboard. The students must sign the class attendance, but they don't need to nad over the activity. The activity is not explicitly linked to the evaluation.

Full-or-part-time: 4h
Practical classes: 2h
Self study: 2h

A8 GUIDE PROBLEM THEME 2, CONTENT 1 (PG2)

Description:
Activity done in the problems class, medium group, consisting on the resolution, individually or in group (maximum groups of 4 students), of a guide problem that collect the main practical aspects of the Content 2. The autonomous self-learning dedication is a stimation of the time that the student need afterwards the class for revising and consolidating the specific objectives of the activity.

Specific objectives:
At the end of the activity, the student should be able to:
- Use the concept of random variable as an element for the description of the variability of a randomized experience and its modeling.
- Identify the distribution of probability and the parameters of expectation and variance of the following discrete random variables: Bernoulli, Binomial and Poisson.

Material:
Preparation / Study: The notes and presentations of the course for the Content 2, particularly the resolution of the examples which have ilustrated the introduction of concepts.
During the activity: The current material and the wording of the guide problem which the professor distribute in the same session.

Delivery:
The exercise is carried out by groups and simultaneously on the blackboard. The students must sign the class attendance, but they don't need to nad over the activity. The activity is not explicitly linked to the evaluation.

Full-or-part-time: 4h
Practical classes: 2h
Self study: 2h

A9 GUIDE PROBLEM THEME 3, CONTENT 1 (PG3)

Description:
Activity done in the problems class, medium group, consisting on the resolution, individually or in group (maximum groups of 4 students), of a guide problem that collect the main practical aspects of the Content 3. The autonomous self-learning dedication is a stimation of the time that the student need afterwards the class for revising and consolidating the specific objectives of the activity.

Specific objectives:
At the end of the activity, the student should be able to:
- Use the concept of random variable as an element to describe the variability of a randomized experience and its modeling.
- Identify the distribution of probability and the parameters of hope and variance of the following continuous random variables: Normal, t-Student, Khi ^ 2 Pearson, and calculate probabilities associated with the aforementioned random variables.

Material:
Preparation / Study: The notes and presentations of the course for the Content 3, particularly the resolution of the examples which have ilustrated the introduction of concepts.
During the activity: The current material and the wording of the guide problem which the professor distribute in the same session.

Delivery:
The exercise is carried out by groups and simultaneously on the blackboard. The students must sign the class attendance, but they don't need to nad over the activity. The activity is not explicitly linked to the evaluation.

Full-or-part-time: 4h
Practical classes: 2h
Self study: 2h

A10 GUIDE PROBLEM THEME 4, CONTENT 2 (PG4)

Description:
Activity done in the problems class, medium group, consisting on the resolution, individually or in group (maximum groups of 4 students), of a guide problem that collect the main practical aspects of the Theme 4. The autonomous self-learning dedication is a estimation of the time that the student need afterwards the class for revising and consolidating the specific objectives of the activity.

Specific objectives:
At the end of the activity, the student should be able to:
- Understand the need and concept of the estimator of a population parameter, as a random variable, based on the information obtained from a sample.
- Differentiate the concepts of bias and consistency of an estimator.
- To estimate the expectation and the variance of a population based on the corresponding sample statistics and for a given level of confidence. In particular, estimate proportions.
- Use the hypothesis test (bilateral and unilateral) for decision making.

Material:
Preparation / Study: The notes and presentations of the course for the Theme 4, particularly the resolution of the examples which have illustrated the introduction of concepts.
During the activity: The current material and the wording of the guide problem which the professor distribute in the same session.

Delivery:
The exercise is carried out by groups and simultaneously on the blackboard. The students must sign the class attendance, but they don't need to nad over the activity. The activity is not explicitly linked to the evaluation.

Full-or-part-time: 4h
Practical classes: 2h
Self study: 2h

A11 GUIDE PROBLEM THEME 5, CONTENT 2 (PG5)

Description:
Activity done in the problems class, medium group, consisting on the resolution, individually or in group (maximum groups of 4 students), of a guide problem that collect the main practical aspects of the Theme 5. The autonomous self-learning dedication is a estimation of the time that the student need afterwards the class for revising and consolidating the specific objectives of the activity.

Specific objectives:
At the end of the activity, the student should be able to:
- Describe sets of two-dimensional data and their variability, numerically and graphically.
- Identify the interrelation between two statistical variables based on the correlation between them.
- Use the regression tools (linear and non-linear) to make predictions.

Material:
Preparation / Study: The notes and presentations of the course for the Theme 5, particularly the resolution of the examples which have illustrated the introduction of concepts.
During the activity: The current material and the wording of the guide problem which the professor distribute in the same session.

Delivery:
The exercise is carried out by groups and simultaneously on the blackboard. The students must sign the class attendance, but they don't need to nad over the activity. The activity is not explicitly linked to the evaluation.

Full-or-part-time: 4h
Practical classes: 2h
Self study: 2h

GRADING SYSTEM

The evaluation of the subject is continuous, each content is evaluated separately from the mean of the test, the laboratory exam and the written exam. The final mark of the subject is the mean of the grades of the two contents.

For every content Ci (i=1,2) there are three tests:
- Qi: Random test with ATENEA, it has 8 questions, with one only answer and with penalization. The test is about the theoretical aspects and the elementary calculus of the Ci content. The test takes 40 minutes.
- Li: Laboratory exam consisting of the resolution of two problems The problems are about data analysis similar to the Integrated Project of the content Ci, it is necessary Minitab software to solve it. The test takes 40 minutes.
- PEi: Exam with problems/questions about the Ci content, it takes 80 minutes.

So that the Ci content has a final mark: Ni = (Qi + Li + PEi) / 3. The final mark of the course is Nf = (N1 + N2) / 2 where:

Nf: Final mark of the course
Ni: Final mark of the Ci content (i= 1,2)

Alternately, if the student according to the section "Normas de realización de las actividades" cannot follow continously the subject then the student will have the chance of doing a final global exam of the subject, consisting in a Q test (40 min), a L test (40 min) and a written test PE (80 min), with a final mark Nf = (Q + L + PE) / 3.

Those students who don't follow the continous evaluation in its two contents blocks and don't present to the final global exam will have a final mark of 0, NP.

The Re-evaluation test will be done within the term established by the School. The Re-evaluation exam is a global exam, consisting of a Q (40 min) questionnaire, a L (40 min) questionnaire and a written PE test (80 min), and with a final grade Nf = (Q + L + PE) / 3.

All the marks indicated in this section are calculated over 10.

EXAMINATION RULES.

For doing the exams of the C1 and C2 contents, the student must comply with:

1) A minimum attendance of 2/3 in the classes for each content.

2) The student must do 3 self-learning tests for each content during the schedule disclosed in ATENEA at the beginning of the course.

3) Each content will have the higher of the self-learning test marks obtained in the 3 attempts and it is necessary that the student have a minimum of 5 points mean among the different contents.

Before the midterm exams of C1 and C2 it will be published in Atenea the list of the students that they CAN NOT attend the partial exam due to do not fulfill some of the previous requirements.

Those students who doesn't comply with some of these requirements will evaluate by the global final exam and won't take into account the possible midterm exam marks of C1 or C2. Anyway the self-learning tests are avaible during all the course for helping the students.

- If some of the evaluable activities of the first content C1 (Q1 test, PE1 written exam or L1 laboratory exam) it will be considered as non marked. Exceptionally a student who couldn't do some of these activities and can justify it, at the discretion of the professor, could do it in the final exam schedule settled for the EPSEB.

- The evaluable activities Qi and Li (for i = 1,2) are done at the same time in a lapse of time of 80 minutes. The student can choose which test to begin first and the time dedicated to each one.
- For the activities the student cannot bring additional material, only a scientific calculator. If during the written exam it is necessary to use some probability table, it will be given with the wording.

BIBLIOGRAPHY

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RESOURCES

Other resources:
Minitab software version 17 or higher.