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340029 - ESTA-N3O43 - Statistics

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering

Teaching unit: 749 - MAT - Department of Mathematics

Academic year: 2018

Degree: BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan

Teaching staff

Coordinator: Enric Trullols

Others: Neus Ybern
Fina Antonijuan
Ester Simó
Carles Batlle
Joana Prat

Prior skills

Ability to apply the basic tools of differential and integral calculus in one real variable.

Requirements

FOMA

Degree competences to which the subject contributes

Specific:

1. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

Transversal:

2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Teaching methodology

In the lectures the instructor presents some motivating ideas, the fundamental concepts and some relevant developments, intermingled with key examples and the resolution of representative problems.

In the lab classes the students learn how to solve some statistical questions, using MINITAB. In the last sessions, several short exercises, to be solved in the lab, will be assigned and graded afterwards.

Learning objectives of the subject

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- Ability to apply the basic techniques to extract statistical information from a database.
- Ability to apply the basic theory of probability
- Ability to apply the distribution models that rules random behavior.
- Ability to apply the techniques of statistical inference to find, from an observation of the population, certain characteristics of the population as a whole.
- Ability to apply the techniques of process quality control to analyze and measure the variability of an industrial process.

Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

1. Descriptive Statistics

Learning time: 2h
Theory classes: 2h

Description:
1.1 Variables. Types.
1.2 Graphical and statistical tools for analyzing one-dimensional variables.
1.3 Graphic and statistical tools for analyzing two-dimensional variables.

Related activities:
Activity 1

Specific objectives:
Ability to use the basic techniques to extract statistical information from a database.

2. Probability

Learning time: 2h
Theory classes: 2h

Description:
2.1 Definition of probability
2.2 Conditional probability
2.3 Independence of events

Related activities:
Activity 3
Activity 5

Specific objectives:
Understand the basic theory of probability

3. Random variables

Learning time: 4h
Theory classes: 4h

Description:
3.1 Definition and types of random variables.
3.2 Density function and distribution function of random variables.
3.3 Expectation and variance of a random variable.
3.4 Distribution models: Binomial, Poisson, Exponential and Normal.
3.5 Central limit theorem.

Related activities:
Activity 3
Activity 5

Specific objectives:
Understand distribution models that govern random behavior.

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4. Quality control

Learning time: 2h

Theory classes: 2h

Description:

4.1 Study of the variability of a process
4.2 Control of variability by variables
4.3 Control of the variability by attributes
4.4 Study of the capacity of a process

Related activities:

Activity 2
Activity 3
Activity 5

Specific objectives:

Ability to apply the techniques of quality control of processes to analyze and measure the variability of an industrial process

5. Inference

Learning time: 1h

Theory classes: 1h

Description:

5.1 Sampling.
5.2 Estimation of parameters.
5.3 Confidence intervals.
5.4 Hypothesis tests.

Related activities:

Activity 2
Activity 4
Activity 5

Specific objectives:

Ability to apply the statistical inference to find, from an observation of the population, certain characteristics of the population as a whole.

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Planning of activities

1: FIRST LAB TEST

Hours: 1h
Theory classes: 1h

Description:
The student will have to solve problems, with the help of MINITAB, using statistical descriptive techniques of content 1.

Support materials:
Statement of the test and class material.

Descriptions of the assignments due and their relation to the assessment:
The written solution of the problems proposed.

Specific objectives:
Confirm the domain of the descriptive statistical techniques using MINITAB

2. SECOND LAB TEST

Hours: 1h
Theory classes: 1h

Description:
The student will have to solve problems, with the help of MINITAB, using the techniques of contents 4 and 5.

Support materials:
Statement of test and class material.

Descriptions of the assignments due and their relation to the assessment:
The written solution of the proposed problems.

Specific objectives:

-Be able to use quality control tools and statistical inference using MINITAB.

3. FIRST THEORETICAL EXAM

Hours: 1h
Theory classes: 1h

Description:
The student will have to solve, in person and in writing, problems on the contents 2 and 3 of probability and random variables. Content 4 will be evaluated in activity 3 or 4 depending on the test schedule.

Support materials:
Statement of test and summary table of theory

Descriptions of the assignments due and their relation to the assessment:
The written solution of the proposed exercices

Specific objectives:
- Be able to use basic probability theory.
- Be able to use distribution models of aleatory variables.
- Be able to use central limit theorem.
- Be able to use the quality control tools

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4. SECOND THEORETICAL EXAM	Hours: 1h Theory classes: 1h

Description:
The student will have to solve, in person and in writing, problems on contents 4 and 5. Content 4 will be evaluated in activity 3 or 4 depending on the calendar of partial exams.

Support materials:
Statement of the test and summary table of theory.

Descriptions of the assignments due and their relation to the assessment:
The written solution of the proposed problems.

Specific objectives:
- Be able to use statistical inference tools.
- Be able to use quality control tools.

5: FINAL EXAM	Hours: 1h Theory classes: 1h

Description:
The student will have to solve, in person and in writing, problems about contents 2, 3, 4 and 5.

Support materials:
Statement of test and summary table of theory

Descriptions of the assignments due and their relation to the assessment:
The written solution of the proposed problems.

Specific objectives:
Be able to use the basic techniques of the subject.

6. RE-EVALUATION TEST	Hours: 2h Theory classes: 2h

Description:
The student will have to solve, in person and in writing, problems about contents 2, 3, 4 and 5.

Support materials:
Statement of test and summary table of theory

Descriptions of the assignments due and their relation to the assessment:
The written solution of the proposed problems.

Specific objectives:
Be able to use the basic techniques of the subject

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Qualification system

A1=laboratory exam with MINITAB
A2=laboratory exam with MINITAB
A3=first partial exam
A4=second partial exam
A5=final exam
A6=re-evaluation test

FINAL GRADE = MAX (0.1*A1+0.1*A2+0.4*A3+0.4*A4, 0.1*A1+0.1*A2+0.8*A5)

(all partial scores on a 0-10 scale)

Regulations for carrying out activities

-The conditions for conducting the individual written tests will be announced with sufficient time.
-It is mandatory to perform at least one of the activities of the laboratory sessions.
-Activities 4 and 5 will be done on the same day and, therefore, only one can be done.
-Only activity 5 can be re-evaluated

Bibliography

Basic:

Ras Sabidó, Antoni. Estadística aplicada per a enginyeria. Barcelona: Edicions UPC, 1995. ISBN 8476532849.

Peña, Daniel. Estadística : modelos y métodos. 2a ed. Madrid: Alianza, 1986-1991. ISBN 8420689931.

Complementary:

Ipiña, Santiago L.; Durand, Ana I. Inferencia estadística y análisis de datos. Madrid: Pearson Educación, 2008. ISBN 9788483224045.

Walpole Ronald E. [et al.]. Probabilidad y estadística para ingeniería y ciencias. 8a ed. México: Pearson Educación, 2007. ISBN 9789702609360.

Prat Bartes, Albert [et al.]. Métodos estadísticos : control y mejora de la calidad. 2a ed. Barcelona: Edicions UPC, 2004. ISBN 8483017865.