

Course guide

340029 - ESTA-N3O43 - Statistics

Last modified: 03/04/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

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

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Simo Mezquita, Ester

Others: Antonijuan Rull, Josefina
Pons Vives, Xavier
Simó Mezquita, Ester
Trullols Farreny, Enric
Ybern Carballo, M. De Las Nieves
Zaragozá Monroig, Maria Luisa

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

- 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

Type	Hours	Percentage
Hours large group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

1. Descriptive Statistics

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.

Specific objectives:

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

Related activities:

Activity 1

Related competencies :

. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

06 URI N1. 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.

Full-or-part-time: 15h

Laboratory classes: 6h

Self study : 9h

2. Probability

Description:

- 2.1 Definition of probability
- 2.2 Conditional probability
- 2.3 Independence of events

Specific objectives:

Understand the basic theory of probability

Related activities:

Activity 3
Activity 5

Related competencies :

. 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.

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06 URI N1. 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.

Full-or-part-time: 15h

Theory classes: 6h
Self study : 9h

3. Random variables

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.

Specific objectives:

Understand distribution models that govern random behavior.

Related activities:

Activity 3
Activity 5

Related competencies :

. 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.

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Full-or-part-time: 32h

Theory classes: 12h
Laboratory classes: 2h
Self study : 18h

4. Quality control

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

Specific objectives:

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

Related activities:

Activity 2
Activity 3
Activity 5

Related competencies :

. 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.

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Full-or-part-time: 23h

Theory classes: 8h

Laboratory classes: 3h

Self study : 12h

5. Inference

Description:

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

Specific objectives:

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

Related activities:

Activity 2
Activity 4
Activity 5

Related competencies :

. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

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Full-or-part-time: 26h

Theory classes: 10h

Laboratory classes: 1h

Self study : 15h

ACTIVITIES

1: FIRST LAB TEST

Description:

The student will have to solve problems, with the help of MINITAB, using Descriptive Statistics techniques and Probability and Random Variables tools of contents 1, 2 and 3.

Specific objectives:

Confirm the domain of the descriptive statistical techniques, Probability and Random Variables using MINITAB

Material:

Statement of the test and class material.

Delivery:

The written solution of the problems proposed.

Related competencies :

. 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.

06 URI N1. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h

Laboratory classes: 2h

2. SECOND LAB TEST

Description:

The second lab test will consist of a Variable Control work (80%) and an Attribute Control Test (20%). The Variable Control work will be assigned after internship session five and will be done in group (2 students). The Attribute Control test will be performed during internship session six individually. Students will carry out the activities, with the help of the MINITAB, using content 1, 2, 3 and 4 techniques.

Specific objectives:

- Confirm the domain of statistical tools using MINITAB.

Material:

Assignment statement and class material.

Delivery:

The work will have to be delivered a week after its allocation.

The Attribute Control test will be submitted during session 6.

Related competencies :

. 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.

06 URI N1. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 5h

Self study: 5h

3. FIRST THEORETICAL EXAM

Description:

The student will have to solve, in person and in writing, problems on the contents 2 and 3 of Probability and Random Variables.

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

Material:

Statement of test and summary table of theory

Delivery:

The written solution of the proposed exercises

Related competencies :

. 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.

06 URI N1. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h

Theory classes: 2h

4. SECOND THEORETICAL EXAM

Description:

The student will have to solve, in person and in writing, problems on contents 4 and 5.

Specific objectives:

- Be able to use statistical inference tools.
- Be able to use quality control tools.

Material:

Statement of the test and summary table of theory.

Delivery:

The written solution of the proposed problems.

Related competencies :

. 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.

06 URI N1. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h 15m

Theory classes: 2h 15m

5: FINAL EXAM

Description:

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

Specific objectives:

Be able to use the basic techniques of the subject.

Material:

Statement of test and summary table of theory

Delivery:

The written solution of the proposed problems.

Related competencies :

. 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.

06 URI N1. 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.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h 15m

Theory classes: 2h 15m

6. REEVALUATION TEST

Description:

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

Specific objectives:

Be able to use the basic techniques of the subject

Material:

Statement of test and summary table of theory

Delivery:

The written solution of the proposed problems.

Full-or-part-time: 2h 15m

Theory classes: 2h 15m

GRADING SYSTEM

A1=laboratory exam with MINITAB

A2=assignment with MINITAB

A3=first partial exam

A4=second partial exam

A5=final exam

A6=reevaluation test

FINAL GRADE = MAX (0.1*A1+0.1*A2+0.35*A3+0.45*A4, 0.1*A1+0.1*A2+0.8*A5)

REASSESSMENT GRADE = 0.1*A1+0.1*A2+0.8*A6

(all partial scores on a 0-10 scale)



EXAMINATION RULES.

- Attendance at laboratory sessions and activities A1 and A2 are compulsory.
- Activities 4 and 5 will be done on the same day and, therefore, only one can be done.
- Only activity 5 can be reevaluated

BIBLIOGRAPHY

Basic:

- Ras Sabidó, Antoni. Estadística aplicada per a enginyeria [on line]. Barcelona: Edicions UPC, 1993 [Consultation: 10/03/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36689>. ISBN 8476532849.
- Devore, Jay L. Probabilidad y estadística para ingeniería y ciencias. 9a ed. México: Cengage Learning, 2016. ISBN 9786075228280.
- Anderson, David R.; Sweeney, Thomas A.; Williams, Thomas A.; Camm, Jeffrey D.; Cochram, James J.; Fry, Michael J.; Ohlmann, Jeffrey W. Statistics for business and economics. 6th edition. Andover, Hampshire: Cengage Learning, 2024. ISBN 9781473791350.

Complementary:

- Walpole Ronald E. [et al.]. Probabilidad y estadística para ingeniería y ciencias [on line]. 8a ed. México: Pearson Educación, 2008 [Consultation: 12/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6766. ISBN 9789702609360.
- Prat Bartes, Albert [et al.]. Métodos estadísticos : control y mejora de la calidad [on line]. 2a ed. Barcelona: Edicions UPC, 2004 [Consultation: 06/04/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36342>. ISBN 8483017865.
- Peña, Daniel. Fundamentos de estadística. 4a reimpresión. Madrid: Alianza Editorial, 2019. ISBN 9788420683805.