Course guides
240042 - 240042 - Statistics

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 715 - EIO - Department of Statistics and Operations Research.

Degree: BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).
BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

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

LECTURER

Coordinating lecturer: PEDRO GRIMA CINTAS

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

Transversal:
1. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

There are two types of sessions: lectures and hands-on sessions. In the lectures (2 hours per week) the teacher explains the basics of the subject using examples and with the minimal mathematical apparatus necessary to understand the concepts.

In the hands-on sessions (2 hours per week), case studies will be solved using statistical packages (with the computer) or using calculator and statistical tables (in classrooms "with blackboard").

Students must prepare the sessions in a self-study manner, following the detailed plan available in the subject's intranet. Material is also offered in this intranet. Throughout the course students must work on a project where they have to analyze data and make decisions based on the information obtained.

LEARNING OBJECTIVES OF THE SUBJECT

After the course the student will be able to:
1. Design how to collect data and how to convert these data into useful information for decision making in environments where there is variability.
2. Understand the concept of variability, how it is measured, the problems it brings and how its influence can be reduced in any process.
3. Know and apply some of the most common techniques of data collection and analysis.
4. Learn the use of statistical software to solve problems as close as possible to those in their future professional work.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

INTRODUCTION TO STATISTICS. DESCRIPTIVE STATISTICS

Description:

Specific objectives:
Knowing and appreciating the possibilities of statistical techniques to obtain information from data.

Related competencies:
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one’s knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one’s knowledge.

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 1h
Laboratory classes: 1h
Self study: 6h

VARIABILITY. PROBABILITY DISTRIBUTIONS

Description:

Specific objectives:
Understanding the concept of variability, how it is measured and the problems it generates. Knowing and being able to use some probability distributions.

Related competencies:
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one’s knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one’s knowledge.

Full-or-part-time: 28h
Theory classes: 4h
Practical classes: 4h
Laboratory classes: 4h
Self study: 16h
ESTIMATION OF POPULATION PARAMETERS

Description:

Specific objectives:
Learning the theoretical foundation for later establishing criteria for making decisions in the presence of variability.

Related competencies:
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Full-or-part-time: 24h
Theory classes: 4h
Practical classes: 2h
Laboratory classes: 2h
Self study: 16h

SIGNIFICANCE TESTS. COMPARISON OF TREATMENTS

Description:

Specific objectives:
Being able to apply the most common statistical tests, and knowing its possibilities and limitations. Also, knowing and being able to apply the most common techniques for collecting and analyzing data for the comparison of treatments.

Related competencies:
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Full-or-part-time: 44h
Theory classes: 10h
Practical classes: 4h
Laboratory classes: 4h
Self study: 26h
MEASURING THE RELATIONSHIP BETWEEN TWO VARIABLES. SIMPLE AND MULTIPLE LINEAR REGRESSION

Description:

Specific objectives:
Being able to identify relationships between variables and to explain the relationship with the most appropriate models.

Related competencies:
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Full-or-part-time: 44h
Theory classes: 10h
Practical classes: 4h
Laboratory classes: 4h
Self study: 26h

EXERCISES RESOLUTION

Description:
The students will have exercises to solve. These assignments will be done individually or in groups, as indicated by the teacher. They will be delivered and discussed in the hands-on sessions. Some of these activities will be assessed by the teacher, self-assessed or co-assessed.

Specific objectives:
Practicing the acquired concepts and having feedback on the level of assimilation and understanding of the concepts.

Material:
Each lessons will have a collection of exercises available at least on the intranet (probably also as printed material).

Delivery:
The exercises done by each student will be used to assess this activity.

Full-or-part-time: 15h
Practical classes: 2h
Self study: 13h
CASE STUDIES

Description:
Students must understand a case study describing a realistic industrial problem. Using a database to be provided, they must determine the appropriate statistical tools to answer questions, using statistical software.

Specific objectives:
Acquiring skills in working with data and the use of statistical software packages. Identifying the appropriate statistical tools to each situation.

Material:
Students will have self-learning videos about the statistical software used, together with the set of cases and databases on the intranet.

Delivery:
The evaluation will be based on questionnaires about the case studies, class discussion and, eventually, in delivering reports.

Full-or-part-time: 15h
Self study: 15h

RESOLUTION OF ONLINE QUESTIONNAIRES

Description:
Students must answer multiple choice questions through the subject’s intranet.

Specific objectives:
Encouraging independent learning, facilitating self-study from the immediate feedback that the student obtains.

Material:
Questionnaires will be available on the subject’s intranet. Eventually, other exercises will be available through a specific web platform.

Delivery:
Either the completion of the questionnaires or their numerical evaluation will be used as evidence for this activity.

Full-or-part-time: 15h
Self study: 15h

PARTIAL EXAM

Description:
Assessment of knowledge.

Delivery:
Solved exam.

FINAL EXAM

Description:
Assessment of knowledge.

Delivery:
Solved exam.
GRADING SYSTEM

The final mark (NF) will consist of four inputs:
1) Continuous assessment mark: AC
2) Mark of the project work: NT
3) Midterm Exam: EP
4) Final Exam: EF

The final mark will be calculated according to:
NF = 0.25*AC + 0.15*NT + 0.15*EP + 0.45*EF

If the revaluation exam is performed, the grade obtained (NR) will replace the EP and EF. Therefore, the final mark in this case will be:
NF = 0.25*AC + 0.15*NT + 0.6*NR

During the spring semester of the 2019-2020 academic year, and as a consequence of the health crisis caused by Covid19, the grading method will be:

As planned, except that there will be no partial exam and its weight will be assigned to the highest mark between the continuous evaluation and the final exam. That is, the final mark (NF) will be calculated as:
If AC > EF: NF = 0.4*AC + 0.15*NT + 0.45*EF
If AC ≤ EF: NF = 0.25*AC + 0.15*NT + 0.60*EF

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Students will have, as written material:
- Copies of the slides used in class.
- Collections of exercises (some with their solution.)
- Collections of case studies.
- Statistical Tables.
All written material will be available, at least, in the subject’s intranet.

Students will have, as multimedia material:
- Educational videos created by teachers of the subject, and available on Videoteca UPC (UPCommons ).
- Links to web pages and videos of interest

Students will have, as software:
- The statistical software package MINITAB. This software is in the computer rooms and also available to students through a campus license.
- The program for HP calculators Stat+, freely available, prepared by teachers of the subject.