Course guides
820076 - AEAE - Advanced Statistics and Applications in Engineering

Last modified: 09/07/2021

Unit in charge: Barcelona East School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2021 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: PABLO BUENESTADO CABALLERO

Others: PABLO BUENESTADO CABALLERO

REQUIREMENTS

Statistics

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Solve mathematical problems that may arise in engineering. Apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation.

Transversal:
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY

The course can be done remotely.

The sessions are done with a computer.

Learning is based on problems applied to different areas.

Each session begins with the presentation of the learning subject and then the students work on the concepts of interest.

The activities are carried out individually or as a couple.

LEARNING OBJECTIVES OF THE SUBJECT

Students gain confidence to tackle problems related to the statistics and their applications in engineering.
The statistic that students learn in this course is very advanced and useful for the future of an engineer.

In recent years a large increase in jobs for engineers in the field of applied statistics is appreciated.
With this course we want to help the student to train in this area.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

INFERENCE BASED ON ONE SAMPLE

Description:
Initially working the usual statistical models for engineering.
Analysis of different types of sampling and sampling the main elements.
We review the basics of inference:
Confidence intervals
Hypothesis contrast

Specific objectives:
Reviewing the most useful engineering statistical models.
Deepen the main concepts related to the inference based on a single sample.
Learn to make decisions by estimating and contrast.

Related activities:
Practical statistical modeling. Recognizes the model from a sample.
Practice simulation to estimate. Experience the mean estimate.
Practice simulation for contrast. Decision making on average.

Full-or-part-time: 40h
Theory classes: 8h
Laboratory classes: 8h
Self study : 24h

INFERENCE BASED ON TWO SAMPLES

Description:
Inference two population means.
Analysis of data pairs.
Inference proportions.
Inference two variances.

Specific objectives:
Enable the student to make decisions for cases with 2 samples.

Related activities:
Practice of Inference for two averages
Practice of inference data pairs
Practice of Inference for two proportions
Practice of Inference for two variances

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

ADJUST MODELS. MULTIPLE LINEAR REGRESSION.

Description:
Using linear regression of two variables for modeling engineering data based on hypothesis testing. Linear model to predict values.
Learn the possibilities of the linear model for nonlinear relationships.
Extend the linear regression model to several variables.

Specific objectives:
Modeling linear relationship between two variables.
Learn the technique of linear modeling of several variables.

Related activities:
Practice of Linear modeling for two variables
Practice of multiple linear modeling

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

ANALYSIS OF VARIANCE

Description:
Learn to perform analysis of variance pruebas of hypotheses.
ANOVA of a single factor.
ANOVA formulation.
ANOVA with two or three factors.

Specific objectives:
Using the ANOVA technique for making decisions with a factor.
Using ANOVA applied to engineering problems with 2 or 3 factors.

Related activities:
Practice of analysis of variance of a factor
Practice of analysis of variance of two factors
Practice of ANOVA of three factors

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

STATISTICAL QUALITY CONTROL

Description:
Apply statistical quality control to make decisions.
Knowing the useful graphical control.
Learning to use acceptance sampling.

Specific objectives:
Train students in the use of different techniques that help make decisions for statistical quality control.

Related activities:
Practice control charts
Practice of Acceptance sampling

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

GRADING SYSTEM

The evaluation focuses on the delivery of individual or couple work (6 reports).
The weight of each report in the final grade is proportional to the time it occupies in the course.

The course can be done without attending the classroom (DISTANCE COURSE IS POSSIBLE).

This subject not has re-evaluation.

EXAMINATION RULES.

The reports must be submitted via ATENEA within the deadline and with good presentation.

BIBLIOGRAPHY

Basic:
- Montgomery, Douglas C; Runger, George C. Applied statistics and probability for engineers. 4th ed. New York [etc.]: John Wiley & Sons, cop. 2006. ISBN 9780471745891.
- Devore, Jay L. Probabilidad y estadística para ingeniería y ciencias. 8a ed. México [etc.]: Cengage Learning, 2012. ISBN 9786074816198.
- Navidi, W. Estadística para ingenieros y científicos. Mèxico [etc.]: McGraw-Hill, 2006. ISBN 9701056299.

Complementary:
- Peña, Daniel. Análisis de datos multivariantes. Madrid: McGraw-Hill, 2002. ISBN 8448136101.
- Aldas Manzano, Joaquin; Uriel Jimenez, Ezequiel. Análisis multivariante aplicado con R. 2a ed. Madrid: Paraninfo, 2017. ISBN 9788428329699.