

66241 - Data and Models for Engineering

Syllabus Information

Academic year: 2024/25

Subject: 66241 - Data and Models for Engineering

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 531 - Master's in Chemical Engineering

ECTS: 6.0

Year: 2

Semester: First semester

Subject type: Optional

Module:

1. General information

The purpose of this subject is for the future engineer to be able to identify, understand and implement the fundamental statistical techniques in the continuous improvement of products and industrial processes. These techniques are introduced using the steps of the Six Sigma methodology, define, measure, analyse, improve and control, and with the help of statistical software.

The subject offers a transversal training in the master's program and is important for all its specialties, providing modelling and data processing tools. They enable the student to perform controlled trials and explain the variability that occurs in them. They are also instructed in the methods necessary for analysis in observational studies.

2. Learning results

1. To identify the appropriate technique to model relationships among several variables, use software to fit the proposed model, and implement the model to predict the value of a variable of interest.
2. To know the techniques of multivariate statistical control of processes as well as the techniques to treat data in the absence of normality or that present time dependence.
3. To know the basis to assess and predict the reliability of a system.
4. To know how to reduce experimentation through the use of fractional factorial experiments.
5. To identify appropriate experimental designs to fit response surfaces.

3. Syllabus

MODULE 1: DEFINE AND MEASURE.

1. Introduction to Six Sigma.
2. Exploratory data analysis and multivariate data summary.
3. Failure time models and system reliability.
4. Accelerated life testing.

MODULE 2: ANALYZE.

1. Simple and multiple regression models.
2. Logistic regression model.

MODULE 3: IMPROVEMENT.

1. Design of experiments in the improvement of the quality and robustness of industrial products and processes.
2. Basic principles of the design of experiments.
3. Factorial designs.

MODULE 4: CONTROL.

1. Production inspection and sampling plans.
2. Process capability analysis.
3. Advanced methods of quality control.

4. Academic activities

Master classes:30 classroom hours.

Presentation of statistical techniques.

Computer laboratory practice:30 classroom hours

Case studies using statistical software.

The theory and practical sessions will be held in a computer laboratory.

Teaching assignments with data and personal study:70 non face-to-face hours for the completion of the assignments of each of the 4 modules and preparation of the public presentation of one of them.

Assessment:6 hours.

Follow-up of the works and public presentation of one of them.

5. Assessment system

At the end of each of the four modules, the student, individually or in groups, will carry out a tutored practical work. Each work involves the application of statistical techniques corresponding to each module.

The first one included the reliability analysis of components and systems corresponding to learning result 3. The second module focuses on regression models and the third on design and analysis of experiments, addressing learning result 4. Finally, the last module on statistical quality control of processes and products is associated with learning result 2. Each work must include a report and will account for 20% of the final grade.

Each student will publicly present one of the papers, chosen by the faculty, on the date established in advance. The defence of the work, evaluated by the four teachers, will account for 20% of the final grade.

Students who have not completed the tutored practical work or have not passed the final grade of 5 may take the global evaluation test on the date established by the Centre. This test consists of a data analysis exercise.

6. Sustainable Development Goals

7 - Affordable and Clean Energy

9 - Industry, Innovation and Infrastructure

12 - Responsible Production and Consumption