

## Introduction to design experiments



**SCHOOL**  
Faculty of Science



**CAMPUS**  
Belle-Beille



**LEVEL**  
2nd year Master's degree



**OPEN TO EXCHANGE STUDENTS**  
Yes



**SEMESTER**  
Fall (S1)

- > **Degree course:** Light, Molecules, Matter
- > **Teaching unit:** UE2
- > **Course language:** English
- > **Duration (hours):** 15
- > **ECTS:** 1
- > **Teacher(s):** Dominique WOLBERT

> **Assessment:**

- Continuous assessment  
 Final exam

> **Teaching methods:**

- Lecture course 11 hours  
 Tutorial course hours  
 Practical work 4 hours

- Case study  
 Project

## COURSE DESCRIPTION

The following courses will be dedicated to the presentation and use of several types of designs, developed to answer different types of problems.

- &gt; Introduction
- ? Objectives, technical and economical interest, investigation methodology.
- &gt; Constitutive elements
- ? The factors: discrete, continuous, ... ; main factors, noise factors,...
- ? Treatments, experimental units,
- ? Observations, special case: quality (reduction of the signal-to-noise ratio).
- ? The expected model, additivity hypotheses of the contributions, state vector, free or constrained effects.
- &gt; Searching for an optimal design of experiments
- ? The sampling variance/co-variance matrix of the effects.
- ? The a priori analysis of an experimentation, optimality criteria.
- ? Execution of a designed experimental set (randomisation, error estimation, ...).
- ? Reminder on the significance of statistical tests, risks, comparison of variance estimations (Fisher-Snedecor test), of mean estimations (Student test, Tuckey test) ...
- &gt; Presentation/use of some types of designs
- ? Discrete factor designs: complete blocking, incomplete, Latin squares, ...
- ? Full factorial designs, 2p designs with interactions.
- ? Fractional designs, Taguchi designs, Box designs ..., notion of aliases, resolution ...
- ? Response surface designs, quadratic designs : Doehlert, composite, Box-Behn-ken.
- ? Mixture designs.
- ? Simplex design for optimum search.

## OBJECTIVES

The goal of the design of experiments is to conceive, execute and study a set of experiments resulting in the best possible compromise between the quality of the requested information (precision, independence, ...) and the experimental effort deployed, considering the formulated hypotheses on the studied system's behaviour. Frequently used by the industrial sector for R&D and quality control, the method appears also more and more for research purpose.