

Faculty: BioScienze e Tecnologie Agro-Alimentari e Ambientali
MASTER DEGREE IN FOOD SCIENCE AND TECHNOLOGY
I YEAR

Course:

**EXPERIMENTAL DESIGN AND
CHEMOMETRICS IN FOOD**
(5 credits – 38 hours)

Teacher: Marcello Mascini
(mmascini@unite.it)

The Teacher is available to answer questions at the end of the lesson, or on request by mail

The course is split in 4 units

UNIT 1: statistical regression

Data, information, models, data types, analytical representation of data

Calibration and regression, Introduction to Statistics

Media & Variance

The Normal distribution, theory of measurement errors, the central limit theorem and the theorem of Gauss

Maximum likelihood, method of least squares, Generalization of the method of least squares

Polynomial regression, non-linear regression, the χ^2 method, Validation of the model

UNIT 3: Data Matrices and sensor arrays

Correlation

Multiple linear regression

Principal component analysis (PCA)

Principal component regression (PCR) and Partial least squares regression - (PLS)

UNIT 2: Design of Experiments

Basic design of experiments and analysis of the resulting data

Analysis of variance, blocking and nuisance variables

Factorial designs

Fractional factorial designs

Overview of other types of experimental designs (Plackett–Burman designs, D-optimal designs, Supersaturated designs, Asymmetrical designs)

Response surface methods and designs

Applications of designed experiments from various fields of food science

UNIT 4: Elements of Pattern recognition

cluster analysis

Potential Method normalization

The space representation (PCA) Examples of PCA

Discriminant analysis (DA) PLS-DA

Examples of PLS-DA

GOALS

The course aims to increase the knowledge of pre and post processing experimental data with multivariate statistical techniques applied to the analysis of foods.

This course will emphasize computer approaches to multivariate statistical analysis. We will discuss how to design, conduct, and analyze experiments in food sciences. Various designs will be discussed and their respective differences, advantages, and disadvantages will be noted. We will examine techniques for data reduction (principal components, factor analysis, and cluster analysis) and for discrimination and classification (cluster analysis, discriminant analysis).

In the first part the course will examine how to design experiments, carry them out, and analyze the data they yield. In the second part it will be compared univariate and multivariate statistical techniques (PCA and PLS). Case studies related to research projects will be taken as practical examples and they will be carried out by using academic free software

knowledge and understanding

This course gives the basis to planning experiments and analyzing complex Experimental Data with more than three variables at the same time.

The program will be elementary in terms of mathematics. The course includes a review of the multivariate background necessary for conducting and analyzing multidimensional scientific experimentation. With this background, we first discuss the logic of hypothesis testing and, in particular, the statistical techniques generally referred to as Analysis of Variance. We will work using add-in software packages in Excel environment.

Throughout the course, we emphasize applications, using real examples from the food areas, including such relatively new areas to solve problems in various contexts of the agri-food sector. The study of the multivariate statistical analysis will allow, for example, the classification of data independently of the development of methods.

making judgements

Students will be able to use a methodology that can be effective for general problem-solving, as well as for improving or optimizing product design and manufacturing processes. Students will work on demo programs or academic-free processing of advanced statistical models using data from the agri-food publications. The results will be presented in the form of reports which will highlight potential, limitations and possible developments of the work performed. Non-attending students will be asked to submit a report online evaluated by the teacher and the attending students.

communication skills

The oral presentation in form of report will help to develop effective communication that is the glue that helps connections to others and improve teamwork, decision making, and problem solving. The practical examples carried out during the course will enable to manage even negative or difficult problems without creating conflict or destroying expectations.

learning skills

At the end of the course, students will be able to design experiments, carry them out, and analyze the data they yield. Moreover students will be able to examine how a rational design allows cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process. Finally they will learn the technique of regression analysis, and how it compares and contrasts with other techniques studied in the degree program.

Course Management

The teacher manage the course through the web platform <http://elearning.unite.it/> . After sign up Students can download all electronics materials of the course. Agenda of the practical use of academic-free programs and of multi-choice tests and reports will be planned at the beginning of the course and uploaded on the web platform. Students can download all electronic supplies (pdf files, software, excel files ect) before classes.

EVALUATION

The tests are held during the semester at the end of the units and are a series of 30 multiple choice questions, related to the specific arguments of the units. The correct answer to each question is 1 point. The wrong answer or no date is 0 points.

In case of you can not do the tests during the course, you can do a final multiple choice quiz of 90 questions at the end of the semester.

The score obtained in the tests will be kept up for one year.

An oral presentation is requested in the form of report which will highlight potential, limitations and possible developments of the work performed. Non-attending students are asked to submit a report online evaluated by the teacher and the attending students.

During the lessons, students can check their learning, through the online test simulator, similar to the examination tests .

The Teacher is available to answer questions at the end of the lesson, or on request by mail (mmascini@unite.it)

BOOKS

Because of the practical application nature of this course there is no mandatory textbook. Instead, you should purchase a text that suits your needs (e.g., practical application versus mathematical statistics). Recommended texts are:

Johnson, Dallas E. (1998). Applied multivariate methods for data analysis. Pacific Grove, CA: Duxbury Press. Good balance between theory and practice.

Tabachnick, B. G. & Fidell, L.S. (2000). Using Multivariate Statistics, 4th Ed. New York: Allyn & Bacon. A traditional and popular text that focuses on practical applications.

Oehlert, Gary W. (2010). A first course in design and analysis of experiments.
(<http://users.stat.umn.edu/~gary/book/fcdae.pdf>)

Barrentine Larry B. (1999) An Introduction to Design of Experiments: A Simplified Approach
Amer Society for Quality

ON THE WEB

<http://elearning.unite.it/course/view.php?id=949#section-0>

YOU CAN FIND

ALL INFORMATION & MATERIALS

JUST SIGN IN!!!!